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Canada's Mineral Trade
The Balance of Payments
and Economic Development

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CANADA'S MINERAL TRADE: IMPLICATIONS FOR THE BALANCE OF PAYMENTS AND ECONOMIC DEVELOPMENT

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FOREWORD

This volume contains the proceedings of the third policy discussion seminar sponsored by the Centre for Resource Studies. The seminar series, instituted in 1977, brings together individuals from governments, industry, universities, and other groups to exchange their knowledge, experience, and views on selected policy issues relating to Canada's mineral resources. The subject of mineral trade was chosen for the third seminar because of its present prominence in Canadian merchandise trade, and because some observers have suggested that increased mineral exports will be required to maintain a viable balance of payments in the face of projected future growth in energy imports.

The seminar was held at the Donald Gordon Centre for Continuing Education in Kingston, and was organized by Dr. Peter R. Richardson, an associate of the Centre and a faculty member at Queen's University. The proceedings were edited by Mrs. Margot J. Wojciechowski, assistant director, and produced by Mrs. Marilyn E. Rivington. The Centre acknowledges their contribution.

We are particularly grateful for the papers prepared by the speakers and for the active participation of other conferees. While final resolution of policy issues can scarcely be expected to emerge from such a seminar, the questions were greatly clarified by the ready exchange of participants' expertise and views.

C. George Miller
Executive Director
Centre for Resource Studies

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CENTRE FOR RESOURCE STUDIES
THIRD CRS POLICY DISCUSSION SEMINAR

CANADA'S MINERAL TRADE: IMPLICATIONS FOR THE BALANCE OF PAYMENTS AND ECONOMIC DEVELOPMENT

In recent years, Canadians have moved from a mood of optimism over the country's economic performance and potential to a mood of concern and even pessimism over future prospects. One factor that has contributed to this concern is the balance-of-payments deficit, which has risen to staggering levels in recent years. Mineral trade has consistently produced a trade surplus, but unfortunately the Canadian mineral industry is currently faced with domestic and external factors that have led to a relative decline in Canada's share of world markets. In addition, the composition of Canada's mineral trade has been altering in recent years, with increasing proportions of nonrefined minerals being exported. The implications of such changes in the composition and magnitude of Canada's mineral trade for economic development in general and, more specifically, in the balance of payments, have not been fully assessed.

At the present time there is no consensus over the impact of Canada's mineral trade on the economy or on the balance of payments, or over policies that government and industry should pursue to counteract the current slowdown in growth of mineral trade. The Centre for Resource Studies designed the present seminar to focus attention on some of these issues, and to encourage debate between representatives of federal and provincial governments, mining companies and academics. A list of participants is included as appendix I.

The seminar was held September 6-8, 1978, at the Donald Gordon Centre for Continuing Education at Queen's University. This residential seminar facility provides an

excellent setting for meetings and for informal discussions among participants before and after the organized sessions. The program included five papers, interspersed with specific as well as general discussions, and is outlined in appendix II.

This volume contains the formal papers as well as a digest of the discussion sessions. The first two papers, by B.W. Wilkinson and D.J. McCulla, discussed trends in the magnitude and composition of Canada's mineral trade, and related policy implications. The third paper, by J.G. MacKinnon, presented an analysis of the potential impact of an increase in mineral exports on the balance of payments and on the exchange rate. In the fourth paper A.G. Balogh gave an industry perspective on opportunities for growth in mining and in further processing of minerals. The final paper, by W.G. Chambers and J.S. Reid, looked at Canada's position as an industrialized resource-exporting nation and the significance of this position in terms of policies for encouraging mineral trade.

TRENDS IN CANADA'S MINERAL TRADE: IMPLICATIONS FOR AN INDUSTRIAL STRATEGY

by

B.W. Wilkinson

INTRODUCTION

There has recently been much debate over whether Canada should attempt to increase the degree of processing of her raw materials, especially minerals, prior to export, and whether there is, in fact, any real scope to do so. Generally speaking, over the years, Canada has not moved rapidly in this regard, and if anything, has lost ground.[1] About 50 percent of Canadian minerals are exported in crude forms; this percentage is greater today than it was 50 years ago. This mix of mineral exports is more like that of a developing than a developed nation. (See table 1.)

It is frequently argued that Canada has done well in the past from exporting crude materials, has a comparative advantage in such products, and should therefore continue with and improve this pattern of trade. To this end, Canada should work to reduce foreign tariffs (which escalate with the degree of processing), attempt to extract economic rents from mineral resources (but not at a level that discourages exploration) and expand the volume of crude exports. Apart from this, there should be little attempt, it is argued, to alter existing mineral trade policies.[2] Support for this stance seems to be growing, as a consequence of that

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1. Wilkinson (1978).
2. For example, see Silver (1975).

Table 1

CRUDE AND SEMI-PROCESSED MINERAL EXPORTS AS PERCENTAGE OF MINERAL EXPORTS AND TOTAL EXPORTS FOR COUNTRY GROUPS, 1972 AND 1976

	Percent of Total Exports				Percent of Mineral Exports			
	Crude Ores and Minerals		Semi-Processed Metals		Crude Ores and Minerals		Semi-Processed Metals	
	1972	1976	1972	1976	1972	1976	1972	1976
Industrial areas[a]	1.7	1.6	8.2	8.1	17.2	16.8	82.8	83.3
Developing areas[b]	7.3	6.0[c]	7.6	5.2[c]	49.1	53.6[c]	50.9	46.2[c]
Eastern trading area[c]	3.1	3.2	9.3	7.9	24.9	28.6	75.1	71.4
Canada	8.6	8.6	8.8	7.5	49.4	53.3	50.6	46.7

Source: GATT, *International Trade 1976/77*, tables 7 and 8.

[a]Includes Canada, USA, EEC, EFTA, Gibraltar, Greece, Malta, Spain, Turkey, Yugoslavia and countries n.e.s., Japan.

[b]Includes all other countries not in eastern trading area, industrial area or oil exporting developing countries.

[c]1975.

[d]Includes Albania, Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania, USSR, China Mongolia, North Korea and Vietnam.

tremendous upswell of opinion which wants a reduction of government in all aspects of life so that markets can operate more freely.

I have some unease with this position. It seems all too pat, too easy. I also have difficulty in believing that simply lower foreign tariffs on processed minerals on the one hand, or possibly less government on the other hand, will significantly improve Canada's performance with respect to mineral trade, or its competitive position (in merchandise trade) in general.

My paper, therefore, is an attempt to come to grips with some of the sources of this unease, to express some of my concerns, and, I hope, to stimulate discussion. I shall begin with a fairly broad perspective relating to Canada's overall balance of payments and the relevant policy aspects. Subsequently, I shall consider the world trading environment in relation to some aspects of international trade theory.

In brief, my conclusions are that, before we rest on our laurels and assume everything will work out for the best, we had better be certain that our macroeconomic policies, particularly as they relate to the balance of payments, are appropriate for Canada's long-run welfare. To this end, it is essential that we have a clear understanding of the forces operating in today's world and our relative position in this world.

THE CANADIAN BALANCE OF PAYMENTS

The Canadian balance of payments for the past two decades is presented in table 2. Since the beginning of the 1960s the current account has been characterized by a surplus on merchandise account (with the exception of 1975) and growing deficits on all service account items (with the exception of freight and shipping where continuous deficits exist but no trend is easily identifiable).

In table 2 I have taken the liberty of making allowance for retained earnings of net foreign direct investment in this country. Conceptually, it is reasonable that such earnings should be included in the balance of payments, first as a service charge on foreign investment and then again in the capital account as an inflow of additional foreign direct investment. This brings the net change in Canada's indebtedness possition, as represented by the balance of payments, more into line with the balance of international indebtedness.[3]

3. Support for this practice comes from various international sources. For example, the IMF *Balance of Payments Manual* specifies that the undistributed profits of foreign direct investment should be included, as did *The Balance of Payments Statistics of the United States* (1965). It is also endorsed in principle by Statistics Canada, although as yet retained earnings from foreign direct investment are not reflected in the official balance of payments statistics (except for the retained earnings of unincorporated branches of foreign companies and the stock dividends paid by wholly-owned subsidiaries to their parent companies —

Table 2

THE CANADIAN BALANCE OF PAYMENTS, 1956-1977
($ Million)

	Current Account									
		Nonmerchandise Items								
				Service Charges on Debt						
	Merchandise Trade Balance	Freight and Shipping	Travel	Interest	Dividends	Retained Earnings[a]	Total	Other Service Items	Net Transfers and Gold Available[b]	Total Non-Merchandise Items	Current Account Balance
1956	-728	- 45	- 161	- 90	- 292	- 400	- 782	- 89	33	-1,044	-1,772
1957	-594	- 70	- 162	- 110	- 331	- 425	- 866	- 194	10	-1,282	-1,876
1958	-176	- 59	- 193	- 118	- 329	- 235	- 682	- 246	- 16	-1,196	-1,372
1959	-421	-105	- 207	- 140	- 351	- 350	- 841	- 224	- 39	-1,416	-1,837
1960	-148	- 91	- 207	- 163	- 322	- 280	- 765	- 259	- 43	-1,365	-1,513
1961	173	- 82	- 160	- 180	- 371	- 240	- 791	- 282	- 26	-1,341	-1,168
1962	184	- 86	- 43	- 194	- 387	- 325	- 906	- 315	11	-1,339	-1,155
1963	503	- 85	24	- 215	- 415	- 435	-1,065	- 332	- 1	-1,459	- 956
1964	701	- 35	- 50	- 251	- 427	- 480	-1,158	- 353	- 9	-1,605	- 904
1965	118	- 93	- 49	- 289	- 475	- 735	-1,499	- 342	0	-1,983	-1,865
1966	224	- 65	- 60	- 319	- 503	- 640	-1,462	- 414	- 25	-2,026	-1,802
1967	566	- 31	423	- 369	- 547	- 845	-1,761	- 507	- 34	-1,910	-1,344
1968	1,471	- 40	- 29	- 444	- 462	- 810	-1,716	- 601	9	-2,377	- 906
1969	964	- 61	- 214	- 489	- 426	-1,045	-1,960	- 600	- 91	-2,926	-1,962
1970	3,052	20	- 216	- 503	- 519	- 905	-1,927	- 612	-116	-2,851	201
1971	2,563	- 12	- 202	- 535	- 606	-1,380	-2,521	- 765	- 12	-3,512	- 949
1972	1,857	- 74	- 234	- 592	- 456	-1,580	-2,628	- 884	- 3	-3,823	-1,966
1973	2,735	- 66	- 296	- 656	- 604	-2,370	-3,630	-1,027	22	-4,997	-2,262
1974	1,689	-224	- 282	- 673	- 880	-2,745	-4,298	-1,215	127	-5,894	-4,205
1975	-451	-433	- 727	- 968	- 985	-2,665	-4,618	-1,108	- 85	-6,971	-7,422
1976	1,339	-148	-1,191	-1,566	- 906	-2,800	-5,272	-1,336	7	-7,940	-6,601
1977	2,916	- 68	-1,641	-2,457	-1,023	-2,800	-6,280	-1,709	-168	-9,866	-6,950

Sources: All items except retained earnings are from Statistics Canada, *Quarterly Estimates of the Canadian Balance of International Payments*, various years. Retained earnings are from Statistics Canada, *Canada's International Investment Position*, 1971-1973.

Notes: For 1974-77, estimates were used. For 1971-73 retained earnings as a percent of corporate profits before taxes were 15.7 percent on average. Hence I have assumed retained earnings were 15 percent of corporate profits for the recent years 1974-77.

[a] In general, retained earnings are, on the one hand, *overstated* because no estimate is currently available on "inflows" of retained earnings on direct investment abroad by Canadian-owned companies. On the other hand, they are *understated* because no provision has been made for retained earnings attributable to foreigners holding portfolio investments of Canadian capital stock. These two sources of bias would approximately cancel out because Canadian direct investment abroad equals about one-fifth of foreign direct investment in Canada, and after being adjusted downward for foreign interests in Canadian direct investment abroad, equals about one-tenth of foreign direct investment in Canada. Portfolio investments in Canadian stock by foreigners also equal about one-tenth of foreign direct investment in Canada. See second source above.

[b] Includes inheritances and migrants' funds, personal institutional remittances and with withholding taxes netted out to zero.

Table 2 (Concluded)

	Capital Account								
		Net Direct Investment							
	Net Portfolio Capital	Net Recorded Flows	Retained Earnings[a]	Total Direct Investment	Balance on Long Term Capital	Basic Balance on Current Account and Long Term Capital	Net Short Term Capital	Balance on Total Capital Account	Charges in Reserves[c]
1956	945	545	400	945	1,890	118	- 70	1,820	48
1957	855	465	425	890	1,745	- 131	26	1,771	- 105
1958	763	390	235	625	1,388	16	93	1,481	109
1959	694	485	350	835	1,529	- 308	297	1,826	- 11
1960	309	620	280	900	1,209	- 304	265	1,474	- 39
1961	450	480	240	720	1,170	2	290	1,460	292
1962	288	400	325	725	1,013	- 142	296	1,309	154
1963	492	145	435	580	1,072	116	29	1,101	145
1964	575	175	480	655	1,230	326	38	1,268	364
1965	423	410	735	1,145	1,568	- 297	455	2,023	158
1966	443	785	640	1,425	1,868	66	- 425	1,443	- 361
1967	849	566	845	1,411	2,260	916	- 896	1,364	20
1968	1,304	365	810	1,175	2,479	1,573	-1,223	1,256	349
1969	1,987	350	1,045	1,395	3,382	1,420	-1,355	2,027	65
1970	417	590	905	1,495	1,912	2,113	- 583	1,324	1,663
1971	-31	695	1,380	2,075	2,044	1,095	- 318	1,726	896
1972	1,368	220	1,580	1,800	3,168	1,202	- 983	2,185	336
1973	420	- 35	2,370	2,335	2,755	493	- 960	1,795	- 467
1974	921	- 50	2,745	2,695	3,616	- 589	613	4,229	24
1975	3,973	-125	2,665	2,540	6,513	- 909	504	7,017	- 405
1976	8,724	-850	2,800	1,950	10,674	4,073	-3,551	7,123	522
1977	4,726	-380	2,800	2,420	7,146	196	-1,617	5,529	-1,421

Sources: All items except retained earnings are from Statistics Canada, *Quarterly Estimates of the Canadian Balance of International Payments*, various years. Retained earnings are from Statistics Canada, *Canada's International Investment Position*, 1971-1973.

Notes: For 1974-77, estimates were used. For 1971-73 retained earnings as a percent of corporate profits before taxes were 15.7 percent on average. Hence I have assumed retained earnings were 15 percent of corporate profits for the recent years 1974-77.

[a] In general, retained earnings are, on the one hand, *overstated* because no estimate is currently available on "inflows" of retained earnings on direct investment abroad by Canadian-owned companies. On the other hand, they are *understated* because no provision has been made for retained earnings attributable to foreigners holding portfolio investments of Canadian capital stock. These two sources of bias would approximately cancel out because Canadian direct investment abroad equals about one-fifth of foreign direct investment in Canada, and after being adjusted downward for foreign interests in Canadian direct investment abroad, equals about one-tenth of foreign direct investment in Canada. Portfolio investments in Canadian stock by foreigners also equal about one-tenth of foreign direct investment in Canada. See second source above.

[c] Including SDR allocations in 1970, 1971 and 1972 of $133, $119 and $117 millions respectively.

The effect of including undistributed profits is to expand the size of the current account deficit by anywhere from $2 to $3 billion to about $7 billion annually in recent years, and to show net foreign direct investment as positive to the extent of $2 billion or more over the past five years, rather than as negative as the official statistics suggest.

The table also clearly shows a huge increase in the travel deficit as a consequence of the surge in vacations to foreign lands, especially to warmer climates during the Canadian winter, and a huge increase in net interest payments over the last few years due to the unprecedented net long-term borrowing since 1975. Other service items, which include payments for managerial and professional services, licences, royalties, and so forth, also have been swelling rapidly.

Significance of Deficit

The significance of the size of the current account deficits of recent years depends on one's point of view. It should be noted that, although the current account deficit as I have defined it seems high for 1976-77, at 3.4 percent of GNE, it was actually no larger than in 1960-61 and was, in fact, less than the 5.5 percent of 1956-57. As long as the accompanying (or causal) long-term capital inflows are used for productive purposes and therefore generate revenues to service the indebtedness, continuing large capital inflows are not viewed with dissatisfaction.[4] Interestingly enough, the federal government's position is that Canada must continue to import much foreign capital.[5]

Nevertheless the question needs to be asked: does Canada really require such large capital inflows in view of much unemployment and unused capacity which are expected

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3. (Continued) which form a fairly small proportion of the total of such earnings).

   Some may argue that the balance of payments is designed to measure the pressures on the foreign exchange market and that to record undistributed earnings in the balance only distorts the presentation for this purpose. This is not really a valid position, however, because between 40 percent and 50 percent of Canada's merchandise trade represents shipments between parents and subsidiaries, and therefore does not enter the foreign exchange market either; this amount is 15 times larger than net retained earnings in dollar value.

4. Or alternately, even if they are used directly for consumption, they free an equivalent amount of other resources in the economy for investment needs; they are thus being used 'productively' and create no servicing problem.

5. The Minister of Finance, responsible for the Foreign Investment Review Act, said: "We know that we need a great deal of new investment to develop our national economic potential. We also know that we will not in the foreseeable future be able to meet all our needs for new capital, technology, etc., from our own resources." (Canada, Finance, 1977.)

to continue for quite a few years into the future? The answer is not straightforward.[6]

Consider initally the situation with respect to the creation of domestic employment. Assume government expenditures are financed by borrowing in financial markets without any accompanying increase in the money supply from domestic sources: that is, pure fiscal policy as it is usually defined. Then, as output expands, interest rates will have to rise to attract funds from other purposes; simultaneously, capital inflows will occur. The higher output will also stimulate larger imports. Empirical work on the Canadian economy suggests that the expansion of imports will tend to be greater than the capital inflow, so that the Canadian dollar will depreciate under a flexible exchange rate,[7] and thus provide an additional stimulus to the economy by encouraging exports and discouraging additional imports.

If, however, the government deficit is financed entirely by borrowing from the Bank of Canada (that is, by an increase in the domestic money supply), no capital inflow need occur. The depreciation of the Canadian dollar would be somewhat more and the stimulus to the domestic economy would be greater. Canada would not have to be increasing its international indebtedness and future debt service costs would not be growing.

Alternately, if the government expenditures are initially financed entirely by borrowing abroad, then upward pressure on the Canadian dollar will generate a current account deficit equal to the capital inflow, and thereby entirely offset the stimulative effect of the government outlays on the domestic economy and employment. This conclusion also holds if the initial injections of spending into the economy are made by corporations which borrow the entire amounts abroad.[8]

From the viewpoint of this particular short-term flow model, the exceptionally large net debt capital inflows since 1975 — or in any other periods of substantial unemployment — had little, if any, favourable impact upon the domestic employment situation, and in that sense were unnecessary. It can, in fact, be argued that

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6. I am very grateful to my colleague, Tom Powrie, for helpful discussions on this section.
7. This is equivalent to saying that in the IS-LM-FE flow-type model used for this discussion, the FE curve is steeper than the LM curve. See Carr, Jump, and Sawyer (1976), pp. 102-120. For more general discussions as to why this should be so, see Kindleberger and Lindert (1978), chapter 20, and Grubel (1977), chapter 18.
8. About 60 percent of the net debt capital inflow in the last few years is the result of provincial government and, to a lesser extent, municipal or city government borrowing. The remainder is corporate borrowing.

they were detrimental because they burdened the economy with additional service charges and repayment costs, and therefore necessitated the export of real resources to make such payments. At the same time, they resulted in no increase in the supply of real resources available to Canadians in the initial period, beyond what would have been possible if domestic unemployed resources had been utilized with the aid of domestic financing. This is quite a different perception from the popular one which suggests that we need foreign capital to help alleviate our unemployment problem.

When other considerations affecting welfare are introduced, the situation becomes somewhat less precise. For example, borrowing abroad instead of letting the currency depreciate means that the terms of trade are more favourable, and hence domestic real income will initially be enhanced. But then again, subsequent debt servicing and repayment adversely affect the terms of trade in future years. To what extent does the latter loss offset the former gain? Even if there is a net terms-of-trade gain over time (which is not at all assured) does it offset the loss resulting from having to export goods and services to service the initial debt? If the borrowing abroad adds to domestic capacity, but there is no net rise in domestic employment (or income) and no net increase in exports, is not there going to be extra unused capacity in the economy? Further, will borrowing abroad during a period of inflation have sufficient restraining effects on import prices and wage demands to result in a significant positive effect on welfare, by lowering the inflation rate and thus offsetting the loss in welfare resulting from the increased foreign debt? Finally, does easy and continued access to funds from abroad have any negative effect on the domestic savings rate?

I do not pretend to have the final answers to these questions, nor have I come across any economic theorizing or empirical work which clearly sets forth the answers. What I am suggesting, however, is that there are enough unanswered questions here to convince us that we cannot take for granted that continuing capital inflows are in Canada's long-term interest, simply because they are not growing larger, relative to GNE or some other magnitude, and because we seem to be able to finance the servicing of them.

Relevance for Mining Sector

What is the relevance of these remarks for issues relating to industrial strategy and the mining sector? Two examples will suffice. First, capital inflows, because they put upward pressure on the value of the Canadian dollar, may tend to discourage the export (or encourage the import) of processed minerals more than they discourage the export (or encourage the import) of crude minerals. This is because the international price elasticities of demand for the former have generally been observed to be higher than for the latter. The fact that Canada is a significant world supplier of a number of crude minerals (see table 3) contributes to the low elasticities for such products. Therefore, although society may agree that it

Table 3

CANADIAN MINERAL PRODUCTION AND RESERVES IN A WORLD CONTEXT

	Canadian Position in Relation to Total World				Canadian Position in Relation to Non-Communist Countries Only[a]				
	Share of World Production 1974-75 Average (Percent)	Share of Identified World Reserves 1975 (Percent)	Rank Among World Producers 1974-75 Average	Rank as Source of Identified World Reserves 1975	Share of Non-Communist Production 1974 (Percent)	Share of Non-Communist Reserves 1974 (Percent)	Rank Among Non-Communist Producers 1974	Rank as Source of Identified Non-Communist Reserves 1974	Canadian Share of American Imports 1970-73 Average (Percent)
Metals									
Iron ore	5	14	6	2	8	19	5	2	51
Nickel	35	16	1	2	43	18	1	2	76
Cobalt	6	7	4	5	8	9	3	4	5
Columbrium	13	8	2	2	13[b]	8[b]	2[b]	2[b]	1
Molybdenum	16	14	2	3	18	17	2	3	35
Tantalum	14[c]	7[c]	3[c]	3	14	7	3	3	23
Tungsten	3	12	6	2	10	40	4	1	35
Copper	11	9	3	4	13	11	3	3	34
Lead	10	10	4	4	13	12	3	3	30
Zinc	20	23	1	1	29	31	1	1	52
Germanium	6	NA[d]	5	NA[d]	6	NA[d]	4	NA[d]	NA
Gold	4	4	3	4	5	4	2	3	48
Mercury	4	2	7	7	7	3	5	6	53
Platinum group	7	2	3	3	12	4	2	2	1
Selenium	20	9	2	3	NA	11	2	3	89
Silver	14	12	2	4	18	18	1	3	44
Stontium	40	NA	1	NA	42	NA	1	NA	0
Uranium	19[e]	NA	2	3	20	23	2	2	80
Other Minerals									
Asbestos	40[f]	40	1	1	65	60	1	1	96
Fluorspar	3[f]	2	11	12	4	3	9	10	0
Potash	21[e]	NA	2		30	NA	1	NA	83

Table 3 (Concluded)

Sources: British North American Committee, *Mineral Development in the Eighties: Prospects and Problems* (1976), table 2. International Economic Studies Institute, *Basic Data for Estimating U.S. Mineral Requirements and Availability: A Research Compendium* (Washington, 1976).

Notes: Identified reserves refer here to known reserves estimated to be economically recoverable at the present. (See first source above, pp. 30-31 for more details.)

NA = not available.

[a]Including Yugoslavia.

[b]Inferred from the first mentioned source.

[c]There appears to be an error in the first source regarding the members here, so the second source was used to correct it.

[d]Mostly recovered from zinc ores and coal ash but estimates of reserves not available.

[e]1973-74 average.

[f]1974 production.

wants to increase the processing of minerals prior to exporting them, policies designed to achieve this may be thwarted by broad macroeconomic policies encouraging capital inflow.

Second, if capital inflows go into a sector such as mining, and the net effect upon the merchandise trade account is to generate a trade deficit equivalent to the capital inflow, the net effect upon total employment may be negative. This could arise because the mining sector is much less labour-intensive than the other sectors, such as mineral processing, which may be facing a decline because of the higher foreign exchange value of the currency. It is often argued that this can be simply resolved, by additional government measures to stimulate domestic employment. However, if these result in the final analysis in additional capital inflows, we end up in a rather vicious and unbeneficial circle.

In general then, aggregate macroeconomic internal and external stabilization objectives and policies need to be developed with a full understanding of their overall impact on welfare, including their impact upon specific sectoral objectives and policies. Similarly, sectoral objectives and policies need to be consistent with aggregate economic policy, so the two are not at cross-purposes with each other. This is hardly a revolutionary thought, but from time to time we seem to lose sight of it. Nor do we seem to consider the possibility that capital inflows may have negative effects on total welfare in times of unemployment.[9]

Some may argue that we should not attempt to relate stabilization policy, which is short-term policy, to the question of greater mineral processing, for the latter is a long-term issue. But such a position ignores the fact that the long term is made up of a series of shorter terms, and that a policy pursued over a number of short terms soon comes to have long-term effects.

MINERAL PROCESSING IN RELATION TO CANADA'S INTERNATIONAL TRADING POSITION

In this section I shall assess the usual arguments concerning why Canada should not expect to expand the proportion of its minerals exported in fabricated form. I shall also suggest that there probably is a role for continued government effort to increase processing. We all have thought about these issues and have our particular views and biases on them; however, I hope to provide one or two new insights.

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9. Capital inflows in full employment situations could also be questioned, although somewhat less so, but I will not take the time to develop this argument here. Also, I do not attempt to discuss the changes which may be required in our financial institutions and in our way of financing provincial government or corporate borrowing in Canada. For example, a new 'lending' branch of the Bank of Canada may be necessary to offset the otherwise relative thinness of Canadian financial markets, if more financing is to be done domestically.

Arguments Against Further Processing of Minerals[10]

Transportation costs favour exporting in crude form. It is argued that shipments of crude materials in large bulk lots, such as in ocean vessels, are cheaper than shipments of the final commodities even though the value per unit of size or weight is much higher on the latter. This may be true, but two comments are relevant.

First, research suggests that transport costs are relatively insignificant as an explanation of international mineral shipments. Much world trade deviates substantially from the patterns that would minimize transport costs.[11] Sometimes shipping costs on certain routes are 10 to 25 percent above the minimum, but these routes continue to be used because other considerations are dominant.[12] Commodity flows may for instance be more influenced by the international vertical and horizontal integration of transnational corporations than by transport costs. We shall return to this subject below.

Second, it may be appropriate to question some of those transportation costs which are cited as being of a determining nature. It is well known that shipping rates may be higher in one direction than in another, or higher on a short haul from one location than on a much longer haul from another location.[13] Hence there is a need to determine whether such differences are really justifiable.

Foreign tariffs escalate with the degree of processing. They therefore discriminate against processed goods, and make it difficult for Canada to achieve economies of scale and international competitiveness (table 4). Japan, the nation importing the highest proportion of Canadian minerals in crude form of any major trading partner, usually has the highest tariff on refined and semifabricated imports, especially of metals.

However, we should be cautious about assuming that, if the Tokyo Round of GATT negotiations produces some significant cuts in tariffs on the various stages of processed minerals, there will necessarily be any substantial expansion in the scale of production and in the amount of processing, either for domestic use or for export. Nor can we assume that if negotiations are unsuccessful there will be no scope for additional processing.

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10. A review of these is provided in Silver (1975). I use this as a focus for my remarks following.
11. Tilton (1966), p. 468.
12. *Ibid.*
13. See Canada, Shipping Conference Arrangements and Practices (1965); also Bryan (1974), pp. 1-13.

Table 4

AVERAGE TARIFF RATES BY DEGREES OF PROCESSING FOR SEVERAL DEVELOPED COUNTRIES, 1973[a]

(Percent)

Commodity	Average Duties on all Imports				Average Duties on Dutiable Imports			
	Canada	USA	Japan	EEC	Canada	USA	Japan	EEC
All Industrial Materials[b]								
All raw materials	0.4	2.3	3.8	0.3	6.3	4.4	10.6	3.5
Semi-finished manufactures	10.6	6.0	6.2	5.9	14.5	9.5	8.9	9.9
Finished manufactures	6.7	9.0	12.0	8.9	14.2	9.5	12.5	9.2
Iron and Steel								
Ores and concentrates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unworked metal	4.0	2.5	5.1	4.0	5.0	5.6	5.1	4.0
Ferro alloys	4.4	3.2	7.0	6.4	5.0	4.2	7.0	7.3
Semi-manufactures	8.4	7.0	10.5	6.9	10.2	7.0	10.5	6.9
Nickel								
Ores and concentrates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unworked metal	0.0	0.0	4.0	0.0	17.5	0.0[c]	13.7	0.0
Semi-manufactures	1.0	2.5	11.2	6.2	14.2	7.1	13.2	6.2
Copper								
Ores and concentrates	0.0	1.3[d]	0.0	0.0	0.0	1.3[d]	0.0	0.0
Unworked metal	0.2	1.7	6.4	0.0	5.0	1.7	6.4	0.0
Semi-manufactures	8.4	3.1	15.3	7.8	8.7	3.1	15.3	7.8
Zinc								
Ores and concentrates	0.0	2.2[e]	0.0	0.0	0.0	2.2[e]	0.0	0.0
Unworked metal	-	4.8	6.8	4.1	-	4.8	7.1	4.2
Semi-manufactures	2.7	2.7	10.3	9.8	11.0	2.7	10.3	9.8
Lead								
Ores and concentrates	0.0	3.8[f]	0.0	0.0	0.0	3.8	0.0	0.0
Unworked metal	-	8.6	6.9	4.5	17.5	8.6	6.9	4.7
Semi-manufactures	3.9	10.8	10.8	9.7	5.0	10.8	10.8	9.7

Table 4 (Concluded)

Commodity	Average Duties on all Imports				Average Duties on Dutiable Imports			
	Canada	USA	Japan	EEC	Canada	USA	Japan	EEC
Asbestos								
Crude	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Articles of asbestos, cement etc.	12.5	1.9	7.5	4.1	12.5	1.9	7.5	4.1
Fabricated asbestos and articles thereof	12.4	5.0	7.5	10.2	14.9	5.0	7.5	10.2
Coal	-	-	-	3.3	-	-	-	3.3
Sulphur								
Crude	0.0	0.0	0.0[c]	0.7	0.0	0.0	0.0[c]	4.0
Sublimed, precipitated	0.0	5.0	4.0	6.4	0.0	5.0	4.0	6.4
Cement and Concrete								
Cement	0.7	-	5.0	4.0	2.0	0.6	5.0	4.0
Articles of concrete	16.9	11.8	7.5	4.0	16.9	11.8	7.5	4.0
Stones, Sand and Gravel	0.6	0.5	0.1	0.2	5.1	2.9	5.0	4.1
Clay	0.5	2.3	0.0	0.0	13.1	2.7	-	-
Glass and Glasswares	10.2	14.0	10.5	10.7	15.0	14.1	10.6	10.7

Source: General Agreement on Tariffs and Trade, *Basic Documentation for the Tariff Study: Summary by Industrial Product Categories* (Geneva, 1974).

[a]Tariffs are for 1973, trade weights are 1971.

[b]See the GATT source for a detailed listing of the tariff items included in each category.

[c]Dutiable items exist, but there was no trade.

[d]Copper price of 60¢ per pound used; specific duty on non-quota ores was 0.8¢.

[e]Zinc price of 30¢ per pound used.

[f]Lead price of 20¢ per pound used; specific duty was 0.75¢/lb.

A few illustrations may serve to clarify this view. First, if the tariffs and economies of scale were all-important, one would have expected to see at least a modest relative rise in the proportion of minerals exported in processed form over the last two or three decades when tariffs were lowered as a consequence of earlier GATT negotiations. The lower Canadian tariff should provide the inducement for domestic processors to look beyond the home market, while the diminished foreign tariff should lessen the obstacles to the export of fabricated goods. Yet this has not generally occurred. Where it has transpired, as with iron and steel products, it does not appear that foreign tariffs were consistently lower than for processed products of other minerals (table 4).

Secondly, notice that the average American tariff on articles of asbestos is only 1.9 percent, and for other fabricated asbestos it is only 5 percent. Neither of these tariffs should be a major hurdle for Canadian sales of fabricated asbestos to the United States. Canada has, as recently as the early 1970s, supplied 96 percent of American asbestos imports; one would think that some leverage would have existed there, yet over 90 percent of all asbestos shipments to the United States have been in crude form. Clearly, tariffs cannot be the sole explanation for the composition of Canada asbestos exports.[14]

Third, other developed nations are exporting highly processed minerals to one another. Their respective tariff structures apparently have not prevented this. Notice too, in this regard, that one way of achieving economies of scale is by exporting.

Fourth, with respect to manufactured goods in general, contemporary research suggests that, with the exception of automobiles and petroleum products, about 70 percent of consumer products (measured by value) could be produced in optimal-sized competitive plants if the population were about one million.[15] Other work suggests that all too often scale has been dictated by the technology of the large transnational corporations and may not be as immutable as once thought. Smaller-scale plants may be developed with alternate technologies and be internationally competitive.[16] Rapid diffusion of new technology may be as important a factor in improving competitiveness as anything — as the success of Canada's iron and steel industry has demonstrated.[17]

14. One argument is that many asbestos products have a large cement component and thus high shipping costs encourage processing nearer the large markets. However, there are many asbestos products which do not fall into this category too. Also, even for those which do, locations for processing in the Niagara Peninsula are certainly as close to much of the U.S. market as many U.S. locations.
15. Stein (1977).
16. See examples cited in Petersen (1977), chapter 3.
17. Baumann (1974) pp. 141-156, shows that the rapid diffusion of new technology was the major factor enabling the Canadian steel industry to advance greatly, relative to the U.S. industry, over the 1955-1970 period.

There are, of course, some situations where the lack of a domestic market of sufficient size, or of a readily available market for by-products, definitely places some constraint on further Canadian processing: for example, copper smelting and refining in British Columbia versus Japan, and the problem of selling the sulphuric acid by-product in British Columbia; and advanced nickel alloy product manufacture in Canada versus existing large market-oriented plants in Britain and the United States.[18] But even here other factors beyond mere tariffs are at work,[19] such as Japanese protectionism and Inco's historic bias against processing in Canada — a subject I shall return to later. Research and development can also be of vital importance in altering the prevailing market situation, such as the work presently going forward to produce basic sulphur rather than sulphuric acid as the by-product from copper, lead and zinc processing.[20]

Finally, recall that a lower value of the Canadian dollar, although it raises the value of imported machinery and equipment, can improve the competitiveness of locations in Canada. This may be true even though foreign tariffs or domestic factors such as construction costs may at the same time prejudice against Canadian production. This possibility of course demands wage-salary restraint so that higher labour costs do not offset the advantage of a depreciated Canadian dollar.

Canada's natural comparative advantage is in crude minerals. It is true that research supports the long-standing contention that natural resources, particularly nonrenewable resources, form the basis of Canada's comparative advantage in trade. We exchange our resource endowments for commodities intensive in labour with high school and/or university education.[21] These findings fit in with a casual analysis of Canada's foreign trade: fully 60 percent of exports are crude and semiprocessed materials: another 20 percent or so are automobile and parts, mostly going to the United States; and the remainder are other highly manufactured goods. Imports are two-thirds highly manufactured goods, about 12 percent semifabricated items and 20 percent crude products and foodstuffs.

But a number of questions have to be asked about this seemingly convincing conclusion. The first question posed here is: to what extent is Canada's comparative advantage in nonreplenishable resources created by government policies, rather than being

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18. See Canada, Industry, Trade and Commerce (1977) pp. 9-12.
19. Japan's restrictions on processed imports make it possible for Japan to pay higher prices for British Columbian crude copper than a smelter and refiner located in that province would deem feasible; they recover the difference by charging steeper prices in their domestic market. See *ibid.*, p. 10. A question arises regarding this situation: to remain competitive in international markets, are the Japanese dumping? And if they are why is this not being counter-acted by other nations including Canada?
20. Canada, Industry, Trade and Commerce (1977) p. 5.
21. Postner, (1975).

completely natural? It has been well documented that minerals are fairly evenly distributed over the earth's surface, and that Canada is actually no more favourably endowed than other land areas.[22] Yet its minerals have been exploited more rapidly than in many places. This has apparently been the result of a number of factors, including proximity to, and the same language and culture as, the United States; this combined with stable government, has meant that Canada has been a logical place for American firms to look for their resource needs. In addition, Canada has generally had well-defined rules and procedures for acquisition and maintainance of mineral rights. It has also provided extensive and detailed mapping data, and constructed essential infrastructure such as roads, railways, airfields, harbours, and communications networks. Consequently Canada has been a favoured place for mineral and other resource exploitation.[23]

A nation's taxation system can also be a determinant of comparative advantage.[24] It is well known that the Canadian corporate tax system has favoured the mining sector in the past and that the tax adjustments of recent years have reduced this favouritism. Table 5 provides some rough evidence on the changing situation.[25]

What is less clear is the total impact of the entire tax-tariff-subsidy system (federal and provincial) upon the mining and manufacturing sectors, and especially upon their comparative advantage. Two studies have attempted to shed some light on this question.[26] Both suggest that the mining sector (excluding mineral fuels) seems to have been favoured less than has manufacturing in general. There are, however, sufficient technical reasons why we should be careful about considering these as definitive statements.[27]

Other complications must also be taken into account. For example, if net benefits to manufacturing are dissipated by having too many plants or plants producing too

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22. For example see Govett and Govett (1976).
23. See Hansuld (1975).
24. Melvin (1975).
25. See also Bernard (1977).
26. Boadway and Treddenick (1977); and Dauphin (1978).
27. To illustrate, the Boadway-Treddenick study assumes for purposes of their model that the return to capital is the same in all sectors — an assumption with no basis in fact. Rental on capital, rather than available capital stock estimates, are used to measure capital. They allow for only two basic factors of production, labour and capital, so no separation of natural resources from other capital is made. Owner-occupied housing, education and health facilities are also included in estimating average taxes paid, even though these sectors do not have any capital or final demand commodity taxes.

    Some curious results come out of the study too, such as the observation that the alcoholic beverages sector, which had $275 million of exports in 1977, would completely disappear if the tariff-tax structure were removed, whereas the automobile sector would increase production 25 percent.

Table 5

TAXABLE INCOME AND INCOME TAXES, AS PERCENT OF BOOK PROFITS BEFORE TAXES, 1969-70 AND 1974-75

Sector	Taxable Income as Percent of Book Profits Before Taxes		Income Taxes as Percent of Book Profits Before Taxes	
	1969-70	1974-75	1969-70	1974-75
Metal mining	21.0	56.4	12.8	22.0
Mineral fuels	2.0	101.0	10.3	36.2
Other mining	7.3	83.6	29.1	33.2
Total mining	14.9	81.4	13.7	30.2
Manufacturing	68.0	83.3	39.9	34.0
Construction	63.8	89.8	37.6	33.4
Transportation, communication and other utilities	56.8	64.0	32.3	30.8
Wholesale trade	84.5	104.4	42.9	45.6
Retail trade	85.8	104.2	40.8	40.2

Source: Statistics Canada, *Corporation Taxation Statistics* 1970 and 1975 (Ottawa, April 1978).

Note: These percentages do not take account of higher provincial taxes since about 1973, some of which are reputed to be, at the margin, greater than 100 percent.

many lines, so that available economies of scale are not achieved, there will be no contribution to an international comparative advantage for Canada in this sector. However, in this case lower profit taxes for the mining sector might enable it to be more competitive internationally in its pricing. In addition, Bernard has demonstrated that the corporate tax system encouraged the use of capital over other inputs.[28] This implies that, *ceteris paribus*, the Canadian dollar has been higher because of additional capital inflows and thus has helped to generate deficits in other commodity trade.

28. Bernard (1977) p. 15.

A second question about Canada's advantage is: to what extent is Canada's comparative advantage being altered by developments in the rest of the world? Comparative advantage is not a static, rigid thing as economic analysis sometimes tends to assume. It is shifting, for one reason or another, all the time. Canada, as the third largest mineral producing country, behind the United States and the Soviet Union, must be considered to be relatively well endowed with minerals when compared to the other major industrial blocks, especially the EEC and Japan. However, in the developing nations the situation is diverging. The advantages in quality and accessibility of mineral deposits in many developing countries, their less stringent anti-pollution laws, their desire to produce minerals even when markets are comparatively glutted because they need the foreign exchange for their economic development, the preferences given to financing mineral exploitation within their borders by some international agencies, and in some instances the preferences given to imports from these countries in industrial nations' markets[29] all lead to concern that Canada's long-standing eminence in world mineral trade will be continually reduced in the coming years by the advances in these lands.

A related concern is that these developing lands are themselves striving to industrialize, and so will be continuing to take whatever avenues are open to them to encourage processing subsequent to the concentration stage, such as smelting and refining. Should not Canada, therefore, with its labour force much more highly educated and trained than the labour forces of the poorer nations, be moving up the processing chain beyond smelting and refining, to more advanced stages of fabrication? In other words, should not Canada take an intermediate role between the developing lands and the large industrial nations? For example, the industrial nations will be making increasing use of recycled minerals, especially metals. One estimate for United States is that presently 40 percent of the copper utilized for manufacturing in a year is from scrap.[30] Apart from the steel industry, will Canada have a metals processing industry able to utilize growing volumes of recycled materials?

Comparative advantage is also created and shifted by technological advances, which in turn are a function of research and development, entrepreneurship, managerial skills and adequate financial backing. Economies of learning by doing and economies of scale can be achieved and maintained by those first in a field. Are these to be more a part of Canada's experience in the future?

The third major question on this point relates to the present overall composition of Canada's merchandise trade balance. Trade surpluses presently exist in forest products, crude minerals, agricultural products, energy, and semiprocessed minerals, in that order (table 6). This means that, broadly speaking, Canada's surpluses are in those commodities for which the long-term income elasticity of demand is quite low, frequently below unity. Hence, as foreign incomes expand, the quantity

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29. See Chambers (1976).

30. Malmgren (1975), p. 24.

Table 6

TRADE BALANCE ON MAJOR COMMODITY GROUPS, 1975-77
($ Billion)

Commodity Group	Trade Balance
Agricultural products	1.3
Forest products	5.7
Crude minerals except energy	2.7
Energy products	1.1
Semi-processed minerals	1.1
Automobiles and parts	- 1.4
Other highly manufactured goods[a]	-10.7
Special transactions — trade	0.3

Source: Statistics Canada, *Summary of External Trade*, December 1976 and 1977.

Note: The numbers will not add up to those presented in table 1, as table 1 figures have been adjusted to a national accounts basis.

[a]Includes industrial and agricultural equipment, other transportation equipment, other equipment and tools, textiles and chemicals, and leather and rubber products.

demanded tends to expand at a slower rate than income. In contrast, our deficits are in highly manufactured products, for which the income elasticity of demand is relatively high, so that as income grows the quantities demanded expand more than in proportion to income growth.[31] Over the years, Canada has been saved from what

31. It is also well known that countries specializing in exporting raw materials generally have more instability in export revenues than do other nations. See MacBean (1966); Erb and Schiavo-Campo (1969); and Massell (1970). But it is also known that instability is less, the more significant are foodstuffs among sales abroad, the more diversified are the number of commodities exported and number of foreign countries to which sales are made, the greater the openness of the economy (using exports as a proportion of GNP as a measure of this), the higher the income per capita (for then the economy is more adaptable), the less unstable is domestic supply, and the larger the share of world markets the nation has. See Stern (1975). Because it possesses many of these stabilizing features in its raw material trade, Canada has been graciously spared wide fluctuations in its export proceeds.

could have been a significant deterioration in her merchandise trade balance by the discovery and development of new resources for export or import replacement. Iron ore, oil, and natural gas in the 1950s, potash in the early 1960s, and coal in the late 1960s and 1970s are three major examples from the mineral sector; there are others of lesser importance such as molybdenum. Rapeseed is perhaps the noteworthy illustration from the agricultural sector. The question arises, therefore: are there other raw materials that may gain new net export or import replacement prominence in the future? Are the new petroleum and natural gas reserves of this magnitude, or will the enforcement of the 200-mile fishing limit be of much significance for the trade balance.

An associated question is: what scope is there for Canada to expand existing exports? Long-run prospects are probably pretty fair for lumber, but somewhat less so for pulp and paper because of new, very competitive production in northern Brazil and in the southern United States. The agricultural protectionism of the EEC and Japan, and their subsidization of exports to third countries, suggest that agricultural markets may not grow as we would like them to. Labour-intensive and mass-produced assembly-line products in Canada will experience increasing difficulty as the developing nations take over more of the market. Hence one might ask whether more processing of minerals and the use of minerals in sophisticated processes based on technological advance are not important possibilities. Postner, after noting the importance of nonreplenishable resources for Canada's trade, does suggest that any comparative advantage we have in secondary manufactured products stems largely from their resource content.[32]

Incidentally, in all these questions I am not asking whether Canada should attempt to shift *completely* out of some dependence upon exports of crude materials. I am merely asking if our comparative advantage in minerals (whether natural, or a consequence of factors over which we had considerable control), is altering significantly, and if so, does this suggest that we must attempt to vary the mix of our mineral exports towards more processed items?

Canada may have a labour shortage. It has been suggested this may be a reason to avoid a policy of further processing. This is a weak argument that would not deserve mention at all, except that it has been used on occasion.[33] Briefly, this position ignores the whole question of changing comparative advantage discussed above, and particularly the fact that Canada should be moving out of low-wage labour-intensive manufacturing as the developing lands take over this sector. Hundreds of thousands of workers would be gradually released from clothing, textiles, toys, electronic components and so on. The shift could not be direct, for in most cases those released probably would not have the skills required in the expanding sectors. But over time, a reshuffling and retaining of workers would occur affect-

32. Postner (1975) p. 69.

33. See Silver (1975) pp. 11-12.

ing all segments of industry. The argument also ignores the fact that, if the jobs created pay higher wages than existing jobs, it is preferable to have the lower paying jobs on the decline.

Additional processing may encourage depletion of resources. This argument is based on the view that encouragement of further processing will necessitate subsidies and these in turn will lower internal Canadian prices, apparently below world prices, and hence stimulate additional consumption in Canada. However, it does not follow that subsidies would result in prices significantly below world levels. It would be more usual simply to ensure prices competitive with foreigners' quotes. For this reason alone, the argument is not a strong one.

Furthermore, if Canada were to rely primarily on greater exports of crude minerals to offset a growing current account deficit,[34] it would have to export even more minerals than if it chose to rely on products entailing additional processing. Also, given what we have already noted about the aspirations of the developing nations to use their mineral endowments to enhance their economic development, Canada could easily be faced with the need to lower export prices. The entire world might then be encouraged to consume minerals at a faster rate. In addition, if Canada had to encourage large extra capital inflows to expand production of crude materials,[35] the dollar would be pushed upwards and other processed exports discouraged.

As for processing requiring more energy resources than simple extraction, this is true only if processing stops at the smelting and refining stage. But as I have suggested above, Canada should perhaps look beyond this stage to more advanced fabrication where energy needs are less even than for extraction, as a percentage of value added.[36] In terms of energy supplies, Canada is in a stronger position than most countries, both developed and developing.

Stimulation of processing will cause retaliation by trading partners. This point would be compelling if the governments of all other nations presently followed a completely hands-off policy, with respect both to the development of their fabrication industries and to trade restrictions. Since they do neither, the argument carries little weight. There are innumerable departures from the standard perfectly competitive model of international trade theory. Government interference, transnational corporations with market power over both demand and supply, and the combination of governments and corporations working together[37] mean that there are many imperfections in the world trading environment.

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34. See Canada West Foundation (1977) especially pp. 23-24.
35. Canada West Foundation favours this too. See *ibid.*
36. Silver (1975) p. 15 has a table supporting this statement, although he himself argues against additional processing — simply because he envisages only the smelting-refining state as the one the nation may strive for.
37. For example the Japanese Ministry of International Trade and Industry (MITI) works closely with Japanese international corporations.

One wonders, for example, to what extent these imperfections are responsible for Canada's trade showing vis-à-vis Japan and West Germany over the past two years. The Japanese yen and the German mark rose 43 percent and 39 percent respectively, relative to the Canadian dollar, between the first quarter of 1976 and the first quarter of 1978. Yet, the value of Canadian imports from these two nations for the first five months of 1978 rose 58 percent and 57 percent respectively compared with the same period for 1976. The value of Canadian exports to these areas rose only 22 percent and 17 percent respectively, and in fact inedible end products to Japan and the entire EEC (excluding the United Kingdom) actually diminished 12 percent and 15 percent respectively over these two periods. One might also ask whether Japanese monopsonistic power was important in the recent coal agreement, covering 95 percent of Canada's coal shipments to Japan for the next year, which permitted only a small price increase in spite of the much greater depreciation of the dollar relative to the yen since the last agreement.[38]

Where there are elements of monopolistic or monopsonistic power in the world economic trading system, the theory of second-best tells us that a nation is unlikely to optimize its welfare by behaving as a perfect competitor and simply 'letting the market work.'[39] Nor is there any rationale for assuming that the interests of the transnational corporation will necessarily coincide with the interests of a host country. It should be noted that, with the exception of the iron and steel industry, a strong element of foreign ownership and control has been and remains an important aspect of most of the Canadian mining and mineral processing sector (tables 7 and 8).

CONCLUDING REMARKS

The preceding pages have suggested that expanding the extent to which Canadian crude minerals are processed prior to export is a reasonable aspiration in an economic sense, that that some government involvement in encouraging the process may be desirable. Hence, I return to the point I made at the beginning of this

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38. The old one-year contract price for Canadian coal shipments to Japan was $55.51 per ton, and with escalations had risen to $58.36 by 31 March 1978. After four months of bargaining, the price was fixed for the next two years at only $59.70 — an increase over the March 1978 figure of only $1.34 or 2.3 percent, and over the earlier initial contract price of 7.5 percent. Yet over the year from the first quarter of 1977 until the first quarter of 1978 the yen had appreciated 30.6 percent vis-a-vis the Canadian dollar, and then appreciated an additional 27.7 percent between the 31 March 1978 and early August 1978 when the agreement was reached. See *Financial Post* 12 August 1978.
39. The seminal article is Lipsey and Lancaster (1956-57). Subsequent extensions of this article do not alter the basic conclusion, particularly if there are interdependencies or externalities among the actors in the system. See Takayama (1972) pp. 472-492.

Table 7

FOREIGN OWNERSHIP AND CONTROL OF CANADIAN MINING AND SELECTED MANUFACTURING INDUSTRIES, SELECTED YEARS

(Percent)

Industry and Country	Foreign Ownership						Foreign Control					
	1926	1954	1960	1965	1970	1972	1926	1954	1960	1965	1970	1973[a]
All Countries												
Mining	–	55	63	63	65	–	–	49	60	64	72	–
Smelting and refining	–	59	54	47	47	–	–	55	64	50	67	–
Total Mining and Smelting	38	56	60	59	59	56	37	51	61	60	70	55
Primary iron and steel	–	16	25[b]	–	–	–	–	6	23[b]	–	–	–
Iron and steel mills	–	32	19	11	–	–	–	–	28	14	1	–
Aluminum	–	–	71	76	–	–	–	–	–	100	100	–
Miscellaneous manufacturing[c]	–	46	53	51	49	–	–	52	63	58	60	–
USA												
Mining	–	51	56	56	55	–	–	46	49	54	59[a]	–
Smelting and refining	–	44	41	36	35	–	–	55	64	50	67	–
Total Mining and Smelting	32	48	52	51	48	46	28	49	53	52	59	44
Primary iron and steel	–	14	–	–	–	–	–	6	–	–	–	–
Iron and steel mills	–	–	20	10	7	–	–	–	14	1	1	–
Aluminum	–	–	–	–	67	–	–	–	–	–	100	–
Miscellaneous manufacturing[d]	–	36	41	42	41	–	–	43	48	44	44	–

Sources: For all countries 1954-1970, Statistics Canada, *Canada's International Investment Position: 1968-1970* (Ottawa: Information Canada, 1975), tables 31 and 32, pp. 152-153. For USA, 1970, *ibid*, table 30, pp. 150-151. For 1926, *ibid*, table 28, pp. 144-145. For USA, 1954-1965, *Canada's International Investment Position: 1926-1967*, table *XX*, pp. 153-195.

Table 7 (Concluded)

Notes: Mining excludes petroleum and natural gas, except for 1926. Smelting and refining includes only nonferrous native ores.

— = not available.

[a]Estimates for 1973 indicate that shifts in a relatively small number of shares have resulted in reductions in these percentages since 1970. The numbers for 1973 are just projections.

[b]Numbers not available from 1960 onward. Iron and steel mills became the new category in the Standard Industrial Classification.

[c]This category includes vegetable products including tobacco; animal products; wood products; iron products including nonagricultural machinery and metal fabricating; other nonferrous metal products including metal fabricating; nonmetallic minerals including cement, glass, and other building materials and products; and some miscellaneous items. Mineral products apparently account for about 40-45 percent of this group.

[d]The same products as in note c are included here with the addition of aluminum.

Table 8

PERCENT OF ASSETS, EQUITY, SALES, AND PROFITS OF MINING AND RELATED MANUFACTURING INDUSTRIES OWNED BY NONRESIDENTS, 1974

Industry	Assets	Equity	Sales	Profits
At Least 50 Percent Nonresident-Owned				
Metal mining	55	49	55	54
Other mining[a]	58	56	62	86
Primary metals[b]	38	38	36	36
Metal fabricating	38	48	38	43
Nonmetallic mineral products	62	72	52	67
At Least 25 Percent Nonresident-Owned				
Metal mining	73	71	74	70
Other mining[a]	66	65	65	88
Primary metals[b]	38	38	36	36
Metal fabricating	40	50	40	45
Nonmetallic mineral products	66	75	56	71
At Least 5 Percent Nonresident-Owned				
Metal mining	98	98	99	97
Other mining[a]	77	82	70	90
Primary metals[b]	54	54	52	55
Metal fabricating	56	65	53	61
Nonmetallic mineral products	77	83	68	80

Source: Statistics Canada, *Corporations and Labour Unions Returns Act: Part I: 1974*, table 2.

[a]Other than metal mining and mineral fuels.

[b]Includes SIC 291, 292, 294, 295-298; that is, iron and steel mills; iron foundaries; smelting, refining, casting and extruding.

paper: that I am skeptical of the position that simply leaving it all to the international markets will be the best for Canada. At the same time, I recognize that there is much room for improvement in the efficiency and effectiveness with which government affairs are conducted, as there is in the lives of us as individuals.

The questions which I have raised regarding the additional processing of crude minerals in this country, although by no means fully answered, demand that we do

not neglect the possibilities which may be open to us in the future in this regard. Finally, we should be very careful that our macroeconomic policies, especially as they relate to foreign capital inflows, do not work at cross-purposes to any industrial objectives we may have.

As a closing note, we might briefly recall how Canada came to have its first nickel refinery. It would not have happened without substantial effort and pressure being brought to bear on Inco by both provincial and federal governments. The peak concern arose during the first World War, when it was reported that Canadian nickel ore and matte, processed in the United States, was being sold to Germany. Calls for nationalization of Inco's interests in Canada arose. 'The political furor and public indignation . . . coincided with a hasty announcement by International that it had selected a site at Port Colborne, and would commence construction immediately.'[40] Had the economics of locating additional processing in Canada suddenly changed?[41] One would hope that we never again have situations of that type. But the event, perhaps isolated as it is, nevertheless has a message to tell us.

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40. See Main (1955) p. 85.
41. Interestingly enough, the Ontario Royal Commission on Nickel reported, after Inco's commitment to build a refinery in Canada, that it would actually be less expensive in Canada than in New Jersey, where Inco had not long before built a new refinery. *Ibid.*, p. 86.

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MINERALS AND THE CANADIAN DEVELOPMENT PROCESS: PARADISE LOST?

by

D.J. McCulla

DEFINITION OF MINERAL INDUSTRY

The Mineral Policy Sector of Energy, Mines and Resources has developed a three-stage definition of the mineral industry. Each stage involves a set of activities or processes, the output of which is a number of commodities at a similar level of processing or fabrication. The very nature of minerals and the complexity of the commodities into which they are processed makes it impossible to group each mineral and commodity into identical sets. Rather, the purpose is, as closely as possible, to group similar industries and commodities. Figure 1 delineates the three stages of the industry.

Stage I, mining, involves the discovery and extraction of ore from the ore bodies and its treatment to the concentrate stage. Stage II is the metallurgical extraction industry, the output of which is a relatively pure metal or alloy. Some of the activities allocated to this stage include smelting, refining, roasting, calcining, direct reduction and leaching. Stage III is the mineral-based semifabricating industry. It involves the shaping of minerals or metals into forms for input into other industries. Output would include rods, plate, sheet, strip, pipes, tubes, castings and forgings of metallic origin, and nonmetallic mineral basic products.

In assigning individual commodities to the mineral industry, as well as assigning them to the various stages, many problems arise. A decision has to be made

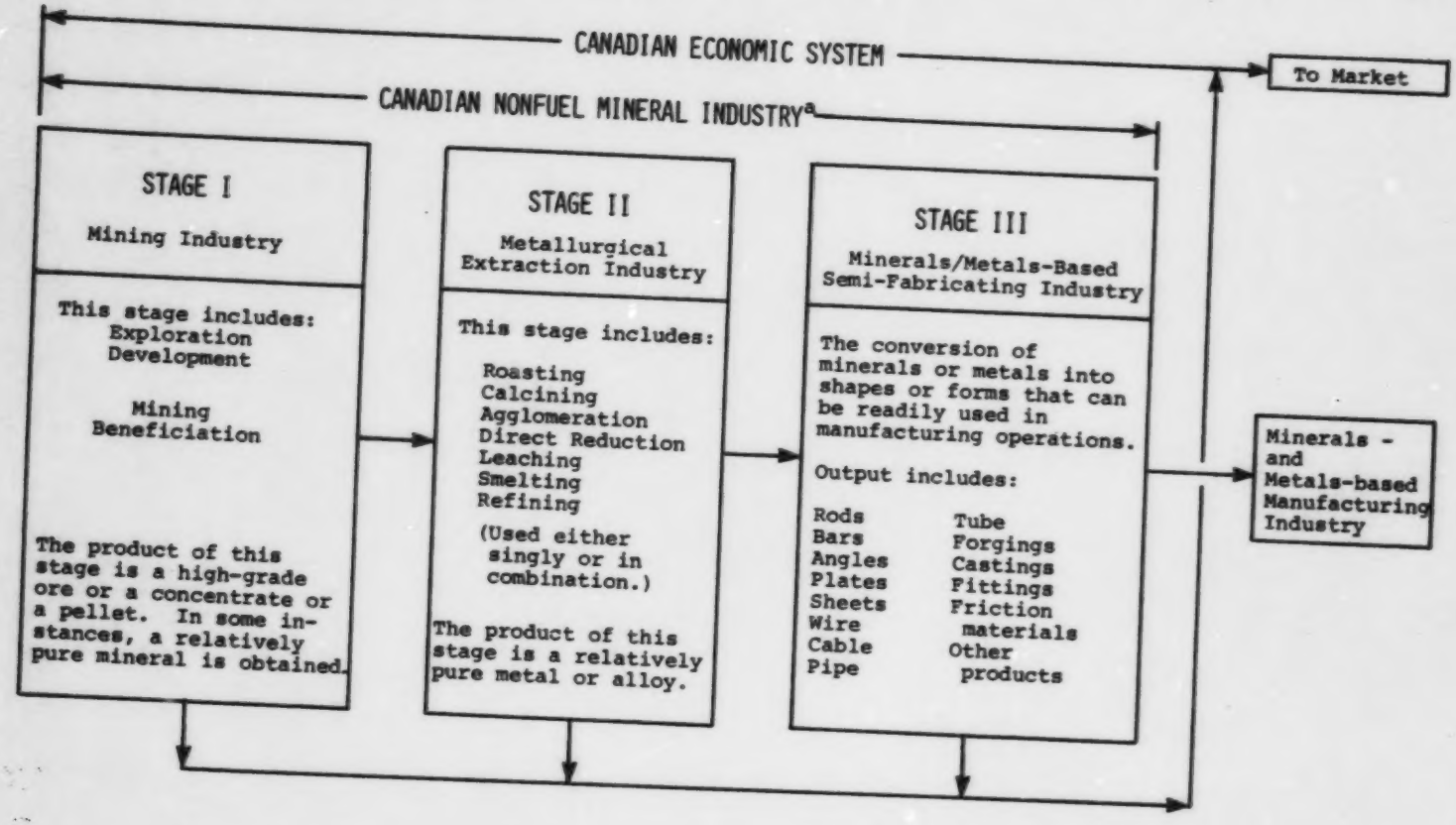

Figure 1. The three stages of the Canadian mineral industry

[a]Includes metals, nonmetallics and structural materials.

concerning the point at which a commodity containing a mineral ceases to be part of the mineral industry. This becomes particularly complex at stage III where output is in the form of cast, rolled or extruded shapes. It is difficult to determine the equivalent stage for some of the nonmetallic minerals. In the case of some chemicals and fertilizers, rather subjective judgements have been made.

The stages are further broken down into ferrous metals, nonferrous metals and nonmetallic minerals. Nonmetallic minerals appear in only stage I and stage III, since there are no equivalent processes at the stage II level.

An EMR report, which is unfortunately still in the production stage, shows the arrangement of mineral industry classes from each of seven statistical classifications (the Standard Industrial Classification (SIC), the Import Commodity Classification (MCC), the Export Commodity Classification (XCC), the Standard Commodity Classification (SCC), the Industrial Commodity Classification (ICC), the Canadian International Trade Classification (CITC), and the Standard International Trade Classification (SITC)) into the three stages of processing. The hope is that as many users as possible will adopt the Mineral Policy Sector's definition. At the present, perhaps the greatest difference between this definition and most others is that a commodity such as nickel matte and oxides is classified as a stage II output or export rather than crude or mine output.

Based upon the three-stage definition, table 1 lists the value of Canada's exports showing each stage as a percentage of total mineral exports. The percentage shares show an obvious trend, particularly to 1973. The importance of stage II is reduced dramatically and that of stage I increases. Stage III demonstrates a gradual increase, more than doubling by the end of the period. The last line on this table represents the portion of total mineral exports filled by stage III nonferrous and nonmetallic products. While in percentage terms stage III has increased in importance, this increase is due primarily to the export of ferrous products. The portion represented by nonferrous and nonmetallic products has remained relatively constant.

Table 2 represents the level of processing of Canada's mineral imports on the three-stage basis. As probably expected, the table shows that by far the greatest portion of mineral imports are, and have been, of stage III products. It is important to note that the ferrous portion of stage III imports is not only much larger than the other stage III imports but is consistently larger than the total imports of either stage I or II. This notwithstanding, at an average 23.5 percent per year of total mineral imports, the stage III nonferrous and nonmetallic imports are also very large.

Table 1

LEVEL OF PROCESSING OF CANADA'S EXPORTS
($ Thousand and Percent)

	1950	1955	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977
Stage I												
Ferrous	15,924	121,578	170,156	369,084	508,892	431,825	371,853	497,706	573,938	717,885	984,279	1,114,947
Nonferrous	57,821	110,750	86,278	234,941	590,315	505,292	588,190	1,001,767	1,270,647	942,296	841,137	933,262
Nonmetallic	69,202	137,591	173,333	231,779	453,574	458,801	479,768	594,538	799,825	792,953	1,122,616	1,310,828
Total	142,947	369,919	429,767	835,804	1,552,781	1,395,918	1,439,812	2,094,011	2,644,410	2,453,134	2,948,032	3,359,037
Percent	23.9	31.6	30.1	36.9	38.2	38.1	38.7	43.5	43.2	43.3	43.5	42.9
Stage II												
Ferrous	38,407	46,860	59,512	71,686	76,319	70,498	69,355	78,103	133,881	109,112	115,348	173,361
Nonferrous	369,731	665,770	772,822	1,068,137	1,881,786	1,687,550	1,644,744	1,926,482	2,328,604	2,153,347	2,626,031	2,910,513
Total	408,138	712,630	832,334	1,139,823	1,958,104	1,758,048	1,714,099	2,004,585	2,462,485	2,262,459	2,741,379	3,083,874
Percent	68.4	61.0	58.4	50.3	48.1	48.0	46.1	41.6	40.2	39.9	40.4	39.4
Stage III												
Ferrous	13,396	25,996	88,005	159,857	353,016	321,975	330,365	408,507	634,473	654,350	735,446	896,756
Nonferrous	23,558	36,397	43,990	74,964	113,527	89,926	111,324	145,076	204,112	134,792	160,046	231,119
Nonmetallic	9,101	24,184	32,265	56,776	92,381	95,857	126,190	164,447	177,922	164,582	193,474	253,589
Total	46,055	86,577	164,260	291,597	558,924	507,758	567,879	718,029	1,016,508	953,725	1,088,966	1,381,464
Percent	7.7	7.4	11.5	12.9	13.7	13.9	15.3	14.9	16.6	16.8	16.1	17.7
Total, all stages	597,140	1,169,126	1,426,361	2,267,224	4,069,810	3,661,724	3,721,790	4,816,625	6,123,403	5,669,317	6,778,377	7,824,375
Stage III												
Less ferrous	32,659	60,581	76,255	131,740	205,908	185,783	237,514	309,522	382,015	299,375	353,520	484,708
Percent	5.5	5.2	5.4	5.8	5.1	5.1	6.4	6.4	6.2	5.3	5.2	6.2

Source: Statistics Canada, and Information System Division, Mineral Policy Sector, Department of Energy, Mines and Resources, Ottawa.

Table 2

LEVEL OF PROCESSING OF CANADA'S MINERAL IMPORTS

($ Thousand and Percent)

	1950	1955	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977
Stage I												
Ferrous	22,200	45,919	53,896	36,111	54,359	50,925	53,091	75,279	94,648	179,512	129,821	111,477
Nonferrous	27,298	33,651	49,212	50,661	118,636	123,558	138,210	193,951	229,002	209,735	173,707	268,630
Nonmetallic	41,388	55,928	41,504	55,210	66,559	75,961	73,776	91,320	124,149	186,410	161,374	173,617
Total	90,886	135,498	144,612	141,982	239,554	250,444	265,077	360,550	447,799	575,657	464,902	553,724
Percent	25.2	26.7	32.1	15.4	21.0	20.0	19.8	21.3	16.4	23.9	21.0	21.6
Stage II												
Ferrous	4,592	6,635	14,462	19,564	43,223	46,568	47,219	57,118	66,324	104,043	88,635	87,482
Nonferrous	12,794	16,301	19,561	174,881	208,739	211,286	224,532	291,791	491,390	374,684	410,688	405,982
Total	17,386	22,936	34,024	194,445	251,962	257,854	271,751	348,909	557,714	478,727	499,323	493,464
Percent	4.8	4.5	7.5	21.1	22.0	21.0	20.3	20.6	20.4	19.9	22.6	19.3
Stage III												
Ferrous	145,760	202,577	200,248	366,527	403,049	455,782	488,197	602,636	1,208,018	848,708	652,633	802,028
Nonferrous	49,968	64,142	40,422	79,769	108,081	124,697	138,645	174,031	235,191	183,533	243,653	294,639
Nonmetallic	56,268	82,906	31,605	139,071	139,036	145,264	173,227	208,143	287,325	320,274	350,170	418,226
Total	251,996	349,625	272,275	585,366	650,166	725,743	800,069	984,810	1,730,534	1,352,456	1,246,456	1,514,893
Percent	70.0	68.8	60.4	63.5	57.0	59.0	59.9	58.1	63.2	56.2	56.4	59.1
Total all stages	360,268	508,059	450,910	921,793	1,141,682	1,234,041	1,336,897	1,694,269	2,736,047	2,406,899	2,210,681	2,562,081
Stage III												
Less ferrous	106,237	147,048	72,027	218,240	247,117	269,961	311,872	382,174	522,516	503,807	593,823	712,865
Percent	29.5	28.9	16.0	23.7	21.6	21.9	23.5	22.6	19.1	20.9	26.9	27.8

Source: Statistics Canada, and Information Systems Division, Mineral Policy Sector, Department of Energy, Mines and Resources, Ottawa.

SCOPE AND METHOD OF STUDY

Having discussed the relative importance and growth of each stage in mineral exports, the remainder of this paper will deal with the implications of this trade situation for economic development.

There have been a number of publications demonstrating the relative impact of each stage's production on value added, labour, energy intensity and income. A recent example is the EMR publication *Mining to Manufacturing: Links in a Chain.* However, this discussion will focus only on economic development and its relation to the stages of the mineral industry. The work is based on a forthcoming EMR publication titled *Interdependence of Industries and Economic Development: The Nonfuel Mineral Industry in the Canadian Context.* This study ranks a large number of industries in the Canadian economy as to their stimulation of economic development. While a broad cross-section of industries is examined, particular emphasis is placed on the nonfuel mineral industry. The method of analysis is similar to that employed in a number of other studies, but differs in that the openness of the Canadian economy to trade is specifically taken into account. The theory employed is based upon interindustry relationships and the primary tool of analysis is the input-output table.

A number of ranking methods are employed and changes in ranking examined. The rankings are repeated, removing biases due to trade. The relationship of the nonfuel mineral industries and the industry aggregation are analyzed. The ranking of the individual industries within each nonfuel mineral industry sector is tested for consistency between the level of processing and ranking.

THEORETICAL MODEL

The analytical framework draws upon the theoretical and empirical works of a number of authors, including A.O. Hirschman, H.B. Chenery and T. Watanabe.

Hirschman defines the shortage of investment decision-making ability as the constraining factor to economic development. The development process is similar to the assembly of a jigsaw puzzle. The efficient sequence of assembly depends upon the pieces already in place and the pressures exerted by them. The pressures exerted by the industries in an economy are backward and forward linkages. Backward linkage is the measure of the stimulation of the industries in an economy caused by any nonprimary activity which induces attempts to supply, through domestic production, the inputs needed in that activity. It is a measure of derived demand. Forward linkage is the measure of the degree to which industries is an economy utilize the domestic production of an activity as an input, rather than letting that production flow to final demand; it is a measure of output utilization.

The nature, size and interaction of these linkages have a significant influence on both the direction and the speed of economic development. Backward linkage is a much more powerful stimulus than forward, due to the former's derived nature. Forward linkage is not an independent inducement mechanism; it is an important and powerful reinforcement of backward linkage. Industries may be ranked as to their stimulation of economic development by utilizing the values of their linkages. According to this theory, the type of industry which has the greatest development stimulus, and consequently the highest ranking, is one which has high backward and forward linkages.

Employing the linkage concepts, Chenery and Watanabe analyzed the interdependence of industries in a number of countries. They utilized input-output tables and the relative importance of forward and backward linkages to rank the interdependence of industries in a four-way classification (figure 2).

Quadrant III SECOND RANKING Final manufacturing industries	Quadrant II FIRST RANKING Intermediate manufacturing industries
Quadrant IV FOURTH RANKING Final primary producing industries	Quadrant I THIRD RANKING Intermediate primary producing industries

Figure 2. Definition of quadrants

Industries with high values for both linkages were given the highest ranking and those with low values for each linkage the lowest. Given the relative importance of the two linkages, industries with high backward and low forward linkages were ranked above those with the opposite characteristics. The findings of Chenery and Watanabe indicate a natural hierarchy of sectors that are uniform in each country analyzed, corresponding closely with levels of processing.

In the present study, sixty-six industries and 137 commodities are employed. Twenty-six of the industries are mineral-oriented and the other forty represent a cross-section of the economy. A larger aggregation would probably change some of the absolute rankings but it is doubtful if it would change the relative positions.

EMPIRICAL RESULTS

Each industry is assigned to one of four quadrants, depending upon whether its associated value of forward and backward linkage is above or below the mean value of each linkage for all industries. Quadrant II represents industries with both linkage values above the mean; quadrant IV represents industries with both linkage values below the mean; quadrant III has industries with only backward linkage values above the mean, and quadrant I only forward linkage values. Utilizing the same classification criteria and a number of iterations, the industries assigned to each quadrant are ranked. The result, figure 3, is a first to sixty-sixth ranking of the industries as to development stimulation.

Perhaps the easiest way to clarify the measuring of forward and backward linkages in this study is to look at an example. The first industry in quadrant III ranks 20th among all industries, it is assigned industry number 60 for reference, and its backward linkage is 66.58 percent. This means that 66.58 percent of the total value of production by this industry is made up of purchases from other domestic industries. The forward linkage is 25.69 percent, meaning that 25.69 percent of the value of output of this industry is sold to other domestic industries as inputs. The remaining 74.31 percent is final demand, which includes exports.

According to the theory, quadrants I, II, and III should, due to the nature of the linkages, correspond to successive stages of processing. Quadrant I is referred to as intermediate primary production; its industries would be expected to be characterized by a low proportion of nonprimary inputs to the value of production and by a large proportion of output going to other industries. The various mining industries fit this definition. Quadrant II is referred to as intermediate manufacture; here, the industries would be characterized by a high proportion of nonprimary inputs to the value of production and by a large proportion of output going to other industries. The casting, rolling, and extrusion of metals industries fit this definition. Quadrant III is referred to as final manufacture; these industries would be characterized by a high proportion of nonprimary inputs to the value of production, with only a small proportion of output going to other industries since final demand is high. The machinery and equipment industries fit this definition. The fourth quadrant, final primary production, contains industries which are relatively independent of other industries, providing a direct link between final demand and primary producers.

Rank	No.	Industry	Lb (Percent)	Lf (Percent)	Rank	No.	Industry	I (Per	Lf Percent)
20	60	Mfgrs. of mixed fertilizers	66.58	25.69	1	51	Ready-mix concrete	6	99.95
21	15	Food processing	64.52	26.66	2	49	Lime	5	76.59
22	21	Pulp and paper	55.14	33.86	3	59	Other petroleum and coal products	5	85.65
23	29	Other smelting and refining	73.20	19.67	4	23	Other paper products	5	73.96
24	58	Petroleum refineries	53.56	44.82	5	31	Copper & alloy, r.c., and ext.	7	65.90
25	5	Iron mines	49.45	26.11	6	26	Steel pipe and tube mills	6	69.06
26	54	Stone products mfgrs.	43.75	37.60	7	30	Aluminum, r.c., and ext.	5	66.12
27	57	Abrasive mfgrs.	43.43	37.69	8	19	Misc. wood industries	6	54.71
28	67	Residential construction	48.27	0.00	9	35	Ornamental and arch. metal	4	92.16
29	68	Nonresidential construction	47.26	0.00	10	47	Electric wire and cable	5	87.08
30	69	Other construction	46.91	0.00	11	39	Heating equipment mfgrs.	5	76.59
					12	2	Forestry	4	95.16
					13	50	Concrete product mfgrs.	4	91.90
					14	36	Metal stamp. press and coat.	5	72.35
					15	37	Wire and wire products	5	71.97
					16	46	Battery mfgrs.	4	60.59
					17	62	Mfgrs. of ind. chemicals	4	53.35
					18	32	Metal cast. roll. and ext.	4	55.73
					19	41	Misc. metal fab.	4	54.44
				III	II				
				IV	I				
48	38	Hardware, tool and cutlery	41.86	29.64	31	55	Other nonmetallic products ind.	4	82.29
49	44	Appliances and communications	40.89	28.43	32	48	Cement mfgrs.	4	82.70
50	8	Petroleum and gas wells	39.03	33.01	33	25	Iron and steel industry	4	75.39
51	53	Refractories mfgrs.	38.15	41.22	34	34	Fabricated struct. metal ind.	3	82.47
52	11	Salt mines	35.37	29.14	35	40	Machine shops	3	95.20
53	45	Mfgrs. of elect. ind. equipment	41.18	23.51	36	70	Water, air and other tranpsortation	3	78.01
54	7	Coal mines	42.24	13.74	37	66	Repair construction	3	76.02
55	42	Misc. machinery and equipment	39.73	15.43	38	33	Boiler and plate works	4	65.10
56	43	Misc. transportation equipment	37.06	7.67	39	52	Clay products mfgrs.	4	55.19
57	64	Scient. and prof. equip. mfgrs.	35.94	9.99	40	27	Iron foundries	3	53.17
58	9	Asbestos mines	36.42	2.97	41	13	Quarries and sand pits	3	77.38
59	4	Uranium mines	31.79	38.27	42	71	Railway transport	2	87.37
60	73	Misc. services and oper. costs	32.46	36.28	43	56	Class and glass products mfgrs.	3	62.55
61	10	Gypsum mines	27.98	30.64	44	1	Agriculture and fishing	3	60.80
62	72	Pipeline transport	21.51	38.89	45	6	Base metal and other metal mines	3	61.93
63	74	Electric power	12.64	47.18	46	14	Services incidental to mining	2	70.08
64	28	Aluminum smelting and refining	28.22	17.62	47	75	Prof. services to business	2	67.71
65	12	Other nonmetal mines	24.46	17.06					
66	3	Gold mines	11.09	16.54					

Figure 3. Actual combined linkage ranking

Notes: Lb = backward linkage. Lf = forward linkage.

To a large extent figure 3 does not show the expected relationship. Quadrant II,

The majority of the top 19 industries are semimanufactured products of the mineral and forestry industries, and as such are the intermediate stage of production. Also included in quadrant II are a number of final demand goods which by definition are expected to be quadrant III: heating equipment, concrete products, batteries and other petroleum and coal products. The forestry industry is a primary or stage I producer and would be expected to appear in quadrant I.

Similar results are found in quadrant III, with the majority of industries being of the final demand type, but with a number of industries seemingly out of place. The pulp and paper as well as the other smelting and refining industries are the first step of processing the output of the primary forestry and mining industries respectively. They are more closely associated with intermediate manufacturing than with final demand and should therefore be expected to be in quadrant II. Iron mines constitute a primary industry that is expected to appear in quadrant I.

In terms of the successive stages, quadrant 1 should and does contain primary industries such as agriculture and fishing, base metal and other metal mines, and quarries and sand pits. These industries all produce primary products with relatively few nonprimary inputs, and their outputs require processing before final use. The majority of industries appearing in this quadrant do not, however, correspond to this category. Industries such as iron and steel, iron foundries, boiler and plate works, as well as a number of nonmetallic mineral products, produce intermediate manufactures and should be in quadrant II. The service and transportation industries are oriented toward final demand and consequently should be in quadrant IV.

Quadrant IV, illustrating both low backward and low forward linkages, shows some expected results with miscellaneous services and operating costs, pipeline transportation and electric power ranking near the bottom, but again most of the other industries appear to be out of place. Mining industries such as coal, asbestos, uranium and gold, as primary intermediate producers, should appear in quadrant I. Final demand manufacturers such as appliances and communications, miscellaneous machinery and equipment and miscellaneous transportation equipment should be in quadrant III. Aluminum smelting and refining should appear in quadrant II.

In general, although the ranking corresponds roughly with the concept of successive stages of processing, there are a large number of industries, including mineral industries, apparently out of place. There is also great variance in the rank position of industries of similar processing levels. Notwithstanding our expectations, it is obvious that many mineral industries rank highly as stimulants of economic development. While figure 3 corresponds with the actual situation

as it was in 1971, and therefore does not measure 'potential' stimulus, figure 4 is a ranking of potential. Here all backward linkage is assumed to be filled domestically, and forward linkage is a measure of the percentage of domestic sales which is utilized as inputs by other industries. The results may be somewhat misleading in that there may be reasons other than economic for the importation of some commodities. The most obvious example is the importation of bauxite as a input into the aluminum smelting and refining industry. Since such examples are in the minority, and since the new ranking is to measure potential stimulation as opposed to fulfillment, I felt it would be useful to classify industries in this way.

Once again let us take the first industry in the third quadrant as an example. This industry has a backward linkage of 88.14 percent, meaning that this percentage of all of its inputs is purchased from other industries, whether foreign or domestic. Its forward linkage is 51.71 percent meaning that, of its domestic sales, this percentage is sold to other industries as input.

The most obvious feature of the potential ranking is that a final demand commodity, other petroleum and coal products, is the highest ranking industry. Otherwise the ranking corresponds more closely to the successive stage concept than does the earlier ranking.

The values of the linkages are by necessity very much higher. The mean value of the potential backward linkage is 50.76 percent as opposed to 42.99 percent for the actual, and the mean value of potential forward linkage is 77.94 percent as opposed to 51 percent for the actual. The rank order correlation between the two rankings is 0.7649 which, while indicating a relatively high correlation, also demonstrates a number of changes in the ranking.

In general, differences tend to be in the direction of a closer alignment of the industries with the concept of successive stages of processing. Quadrant II contains largely intermediate manufacturing industries. Aside from the highest ranking industry, the top seventeen industries are all of this type. Of the industries seemingly out of place, heating equipment manufacturers, battery manufacturers, and other paper products are producers of products which do not require further processing and would be expected to be in quadrant III. Iron mines is a primary producer and would be expected to be in quadrant I. All of the industries in quadrant III produce commodities requiring little further processing and are consequently in this quadrant. The first four industries in quadrant I are more closely associated with intermediate manufacturing and consequently with quadrant II. There are also a number of industries more closely associated with the other two quadrants. The majority of primary intermediate producers are, however, found in this quadrant. The industries in quadrant IV are to a large extent those associated with quadrants I and III. The majority of the primary final products producers are found in quadrant I, particularly the service and transportation industries.

Rank	No.	Industry	Lbp (Percent)	Lfp (Percent)
27	58	Petroleum refineries	88.14	51.71
28	43	Misc. transportation equip.	70.03	46.58
29	15	Food processing	71.31	32.60
30	42	Misc. machinery and equipment	56.37	40.33
31	44	Appliances and communications	55.65	48.93
32	68	Nonresidential construction	54.55	0.00
33	67	Residential construction	54.50	0.00
34	69	Other construction	52.22	0.00
				III
				IV
57	38	Hardware, tool and cutlery	48.80	52.39
58	54	Stone products mfgrs.	46.54	50.97
59	45	Mfgrs. of elect. ind. equip.	50.49	43.48
60	64	Scient. & prof. equip. mfgrs.	47.88	38.18
61	66	Repair construction	39.52	76.02
62	9	Asbestos mines	37.45	49.52
63	74	Electric power	17.20	48.40
64	73	Misc. services & oper. costs	36.92	38.93
65	11	Salt mines	36.24	37.80
66	4	Uranium mines	34.76	45.47

Rank	No.	Industry	Lbp (Percent)	Lfp (Percent)
1	59	Other petroleum and coal products	66.76	100.00
2	51	Ready-mix concrete	66.32	99.98
3	49	Lime	66.14	99.72
4	47	Electric wire and cable	64.19	98.47
5	31	Copper and alloy r.c., and ext.	81.11	98.04
6	26	Steel pipe and tube mills	71.75	98.08
7	60	Mfgrs. of mixed fertilizers	74.17	95.48
8	30	Aluminum r.c., and ext.	69.34	97.98
9	32	Metal cast. roll. and ext.	66.42	98.05
10	29	Other smelting and refining	82.30	88.29
11	19	Misc. wood industries	64.14	93.32
12	62	Mfgrs. of ind. chemicals	58.38	97.35
13	35	Ornamental and arch. metal	59.79	94.81
14	37	Wire and wire products	57.88	95.60
15	21	Pulp and paper	58.43	94.94
16	25	Iron and steel industry	54.21	98.43
17	53	Refractories mfgrs.	52.17	97.16
18	39	Heating equipment mfgrs.	62.58	88.90
19	57	Abrasives mfgrs.	61.02	91.56
20	36	Metal stamp. press. and coat.	61.05	87.65
21	23	Other paper products	62.63	84.53
22	46	Battery mfgrs.	59.06	79.95
23	41	Misc. metal fab.	56.25	91.43
24	28	Aluminum smelting and refining	52.33	91.92
25	5	Iron mines	51.63	89.82
26	33	Boiler and plate works	54.10	76.90
				II
				I
35	27	Iron foundries	47.75	98.66
36	50	Concrete products mfgrs.	47.07	98.93
37	55	Other nonmetallic prod. ind.	47.23	98.13
38	34	Fabricated struct. metal ind.	45.89	98.70
39	7	Coal mines	45.28	93.68
40	40	Machine shops	42.53	95.20
41	48	Cement mfgrs.	42.68	94.95
42	8	Petroleum and gas wells	40.56	94.40
43	2	Forestry	49.36	98.56
44	52	Clay products mfgrs.	46.92	81.37
45	56	Glass and glass products mfgrs.	42.20	88.52
46	70	Water, air and other tranpsortation	40.66	83.61
47	6	Base metal and other metal mines	33.81	99.47
48	10	Gypsum mines	31.79	95.55
49	3	Gold mines	15.34	100.00
50	12	Other nonmetal mines	26.83	94.63
51	71	Railway transport	24.31	96.67
52	1	Agriculture and fishing	36.19	82.86
53	13	Quarries and sand pits	36.18	91.45
54	14	Services incidental to mining	28.85	70.08
55	75	Prof. services to business	24.17	79.35
56	72	Pipeline transport	22.06	79.53

Figure 4. Potential combined linkage ranking (less exports)

Notes: Lbp = potential backward linkage, incorporating imported inputs. Lfp = potential forward linkage, excluding exported outputs.

The combined-linkage ranking in figure 4 aligns more closely the type of industries expected to be associated with each quadrant. There still remain, however, a number of industries apparently out of place. More important than the association with particular quadrants is the fact that the rankings have a close relationship with the concept of stages of processing. As a result the rank positions of the mineral industries tend to increase from the first ranking method to the second. This is particularly true of the stage II and III metal industries. The effect is to show that in terms of development stimulus, while mineral industries ranked high compared with all other industries in the actual ranking, they are even higher in a potential ranking.

Forgetting about all but the mineral industries, table 3 lists the two rankings for 26 mineral sectors. It shows that within the industry itself the change in ranking methods leads to few changes; the notable exceptions are several of the nonmetallic industries.

Table 3

NONFUEL MINERAL INDUSTRY

Reference Number	Name	A Rank	B Rank
51	Ready-mix concrete manufacturers	1	1
49	Lime manufacturers	2	2
31	Copper and alloy rolling, casting and extruding	3	3
26	Steel pipe and tube mills	4	4
30	Aluminum rolling, casting and extruding	5	5
50	Concrete products manufacturers	6	15
32	Metal rolling, casting and extruding	7	6
29	Other smelting and refining	8	7
5	Iron mines	9	12
54	Stone products manufacturers	10	24
57	Abrasive manufacturers	11	10
55	Other nonmetallic product industries	12	16
48	Cement manufacturers	13	17
25	Iron and steel industry	14	8
33	Boiler and plate works	15	13
52	Clay product manufacturers	16	18
27	Iron foundries	17	14
13	Quarries and sand pits	18	23
56	Glass and glass products manufacturers	19	19
6	Base metal and other metal mines	20	20
53	Refractories manufacturers	21	9
11	Salt mines	22	26
9	Asbestos mines	23	25
10	Gypsum mines	24	21
28	Aluminum smelting and refining	25	11
12	Other nonmetal mines	26	22

Notes: A Rank = actual combined linkage ranking. B Rank = potential combined linkage ranking (less exports).

Finally, table 4 lists the two rankings for each stage within each of the ferrous, nonferrous and nonmetallic sectors. Little discussion of this table is necessary. In general, the higher the level of processing the higher the ranking. Of particular note are the three stage III nonferrous industries, which in the potential ranking of all industries are in the top ten; they are in the top six of the mineral industry ranking and have the top rank in the nonferrous sector.

Table 4

THE NONFUEL MINERAL INDUSTRY BY SECTOR AND STAGE: RANK WITHIN STAGE

Sector			
Stage	Name	A Rank	B Rank
	Nonferrous Metals		
I	Base metal and other metal mines	4	4
II	Other smelting and refining	3	3
III	Copper and alloy r.c., and ext.	1	1
	Metal cast. roll. and ext.	2	2
II	Aluminum smeltings and refining	2	2
III	Aluminum roll. cast. and ext.	1	1
	Ferrous Metals		
I	Iron mines	2	3
II	Iron and steel industry	3	2
III	Iron foundries	5	5
	Steel pipe and tube mills	1	1
	Boiler and plate works	4	4
	Nonmetallic Minerals		
I	Asbestos mines	13	14
	Gypsum mines	14	10
	Salt mines	12	15
	Quarries and sand pits	9	12
	Other Nonmetal mines	15	11
II	Ready-mix concrete	1	1
	Cement mfgrs.	7	7
	Lime mfgrs.	2	2
	Concrete mfgrs.	3	5
	Clay products mfgrs.	8	8
	Refractories	11	3
	Stone products mfgrs.	4	13
	Glass and glass products mfgrs.	10	9
	Abrasive mfgrs.	5	4
	Other nonmetallic prod. ind.	6	6

Notes: A Rank = actual combined linkage ranking. B Rank = potential combined linkage ranking (less exports).

Historically the greatest total benefits to Canada, including stimulation of economic development, have been derived from the first stage of the industry followed by the second. The absolute size of these stages has insured this. Studies such as *Links in a Chain* have however shown that the greatest incremental benefits in terms of labour, value added etc. are derived from the higher levels of processing. The present study shows that development stimulation is greatest at the third stage followed by the second for metals, with the first stage providing the least stimulation.

The actual level of processing of Canada's exports has demonstrated the reverse trend, with stage I becoming more important, stage II becoming less so, and stage III being stagnant. At the same time stage III imports represent by far the largest share of mineral industry imports.

It is this kind of information which leads to the debate whether Canadians should be 'hewers of wood and drawers of water.' The conclusion of this argument, in the light of the analysis presented here, must be that if further processing does not take place in Canada, then at least a portion of Canada's potential future economic development will continue to be the economic development of our trading partners. Hence the phrase in the title: Paradise Lost?

The question mark is to my mind very significant. The association of potential economic benefits and economic development with the levels of processing may be merely an interesting theoretical study, or an idealistic goal, if opportunities for this processing are only illusory.

The question which must be asked is whether there are real opportunities to increase the percentage of exports represented by stages II and III, particularly of the nonferrous metals, or to replace imports of these commodities. What are the barriers to such processing? Are these barriers economic, or are they institutional, or perhaps a combination of the two? These questions must be asked on a commodity-by-commodity, project-by-project basis.

If these barriers are surmountable, then perhaps imaginative action by industry and governments may lead to an increase in the domestic processing of minerals and hence provide a further development stimulus for Canada.

METHODOLOGICAL APPENDIX

By 1971 Canadian national input-output tables, as developed by Statistics Canada, are the primary tools of analysis.[1] These very large tables are rectangular rather than of the more traditional square configuration. The 191 industries and 587 commodities have been reduced to 66 and 137 respectively for the present analysis.

The two key assumptions normally associated with input-output analysis are required:

i) *The industry technology assumption* requires that each industry utilize commodity and primary factor inputs in fixed proportions. The proportions are common for each commodity produced by the industry.

$$u_{ij} = b_{ij}\, g_j$$

The input of the i th commodity into the j th industry, u_{ij}, is a fixed proportion b_{ij} of the output of the j th industry g_j

where: $i = 1, ----, 137$

$j = 1, ----, 66$

$$y_{kj} = h_{kj}\, g_j$$

The input of the k th primary input into the j th industry, y_{kj}, is a proportion, h_{kj}, of the output of the j th industry g_j

where: $k = 1, ----, 5.$

ii) *The market share assumption* requires that the demand for domestically produced commodities is allocated among industries according to fixed market shares and that imports of each commodity are proportional to domestic use of the commodity.

$$v_{ji} = d_{ji}\, q_i$$

The j th industry's output of the i th commodity, v_{ji}, is a fixed share, d_{ji}, of the total amount of the i th commodity produced in domestic industries q_i.

$$m_i = \mu_i \left(\sum_j u_{ij} + \sum_k f_{ik}\right)$$

The imports of the i th commodity, m_i, are a fixed proportion, μ_i, of intermediate demand for the i th commodity in all industries, $\sum_j u_{ij}$, plus the domestic final demand for the i th commodity, $\sum_k f_{ik}$.

Domestic final demand includes: personal consumption, change in inventory, investment, and government purchases. Total final demand includes domestic final demand and exports.

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1. Dominion Bureau of Statistics (1969).

$$q_i + m_i = \sum_j u_{ij} + \sum_k f_{ik} + x_i$$

where: x_i is the value of commodity i exported.

$$Lf_i = \frac{\sum_j u_{ij} - \mu_{ij} \left(\sum_j u_{ij}\right)}{q_i + m_i}$$

where: Lf_i is the forward linkage of commodity i produced by industry j

i = 1, ---- 66

j = 1, ---- 66

Since there is a direct one-to-one relationship between industries and commodities, the forward linkage of a commodity is that of the corresponding industry.

$$q_j = \sum_i u_{ij} + \sum_k y_{kj}$$

$$Lb_j = \frac{\sum_i u_{ij} - \mu_{ij} \left(\sum_i u_{ij}\right)}{q_j}$$

The backward linkage of any industry, Lb_j is the proportion of the total input requirement of that industry which is purchased from domestic industries.

Potential forward linkage is valued so as to measure the portion of the domestic disposition of each commodity sold to industries as intermediate inputs.

$$Lfp_i = \frac{\sum_j u_{ij}}{q_i + m_i - x_i}$$

The potential backward linkage, Lbp_j, is the portion of total inputs into each industry purchased from industries.

$$Lbp_j = \frac{\sum_i u_{ij}}{q_j}$$

Reference: Dominion Bureau of Statistics, *The Input-Output Structure of the Canadian Economy, 1961* (Ottawa, 1969).

NEW MINE DEVELOPMENT:
THE IMPACT ON CANADA'S BALANCE OF PAYMENTS

by

J.G. MacKinnon

INTRODUCTION

The purpose of this paper is to examine how an increase in the size of Canada's nonferrous metal mining industry would affect the Canadian balance of payments. The figures we obtain are, of necessity, extremely crude, but should nevertheless be useful in indicating orders of magnitude. Iron mining and the mining of non-metallic minerals such as coal, potash and asbestos are not dealt with in this study: these industries were deemed to be sufficiently different from the non-ferrous metal mining industry to require separate treatment.

An increase in the size of Canada's nonferrous metal mining industry would affect the balance of payments in a number of ways. If it is assumed, as we do in this study, that Canada faces fixed world prices for metal ores and concentrates, then any increase in production must lead to an equal increase in exports, since domestic sales could rise, *ceteris paribus*, only if prices were to fall. These increased exports will be to some extent offset, however, by imports of machinery and equipment and other imported materials and supplies. There may also be substantial effects on the balance of payments if new mines are financed, either directly or indirectly, through foreign borrowing. During periods when many new mines are being opened there will tend to be a net inflow of capital, and during later periods there will tend to be a net outflow of interest, dividends and principal repayments.

The three balance-of-payments effects described in the previous paragraph are what may be termed the direct effects of a change in mining activity. They can, in principle, be measured fairly easily for any given mining project if enough data are available. There will also be indirect effects, which are much harder to measure. Suppose first that the Canadian economy is operating at capacity. In order for the nonferrous metal mining industry to expand in size, it must bid factors of production away from other industries. The resulting contraction of these other industries will also have balance-of-payments effects, which will presumably tend to offset the direct effects mentioned above. Measuring these effects accurately, however, would be all but impossible without an extremely detailed and complicated model of the entire Canadian economy, of a type which does not exist today.

Alternatively, suppose that the Canadian economy is operating so far below capacity that no factors of production have to be bid away from other industries. Thus the increase in mining activity will lead to a net increase in Canadian GNP which, because of the multiplier effect, will be larger than the increase in mining activity itself. But as GNP rises, so do imports, and this rise in imports will partially offset the higher export revenues created by increased mining activity. Thus, once again, the indirect effects will tend to offset the direct effects. In this case, estimating the magnitude of the offset is not too difficult. Since, in view of current unemployment figures, it does not seem too unreasonable to assume that the Canadian economy is not now operating at capacity, we shall employ that assumption in measuring indirect effects.

This paper does not consider the question of what might cause the nonferrous metal mining industry to expand in size. Whatever events are responsible for the expansion might themselves have balance-of-payments effects. In particular, if world prices for metal ores and concentrates were to increase, that would affect the Canadian balance of payments through its impact on receipts from existing production as well as through its tendency to encourage new production. Alternatively, some type of government action would be required to stimulate mining activity at current world prices. This government action might itself have direct effects on the balance of payments (for example, if reduced taxes on mining caused the government to resort to increased foreign borrowing), and indirect effects through induced changes in factor and product prices. Such effects will not be considered here.

As table 1 shows, Canada's exports of nonferrous metals are substantial. The table shows the total value of exports of ores and concentrates and of semiprocessed metals (primary metals and shapes) for each year from 1970 through 1976, broken down by metal. In 1976, the total value of these exports was approximately $3.2 billion, or about 8.5 percent of Canada's total merchandise exports of $37.3 billion. Over the 1970-76 period as a whole, nonferrous metal exports were even more significant, averaging 10.2 percent of total merchandise exports. The share

Table 1

VALUES OF CANADIAN EXPORTS OF NONFERROUS METALS

($ Million)

	1970	1971	1972	1973	1974	1975	1976
Copper:							
Ores and concentrates	262	223	272	557	648	331	343
Semi-processed	475	385	408	522	654	476	523
Total	737	608	680	1,079	1,302	807	866
Lead:							
Ores and concentrates	43	37	34	52	65	56	35
Semi-processed	46	32	37	43	41	50	51
Total	89	69	71	95	106	106	86
Nickel:							
Ores and concentrates	372	407	384	442	438	516	524
Semi-processed	434	320	312	377	440	417	444
Total	806	727	696	819	878	933	968
Zinc:							
Ores and concentrates	125	137	129	198	319	297	242
Semi-processed	91	81	128	204	227	205	274
Total	216	218	257	402	546	502	516
Precious Metals:							
Ores and concentrates	83	78	68	89	173	160	135
Semi-processed	47	29	34	60	103	109	357
Total	130	107	102	149	276	269	492
Radioactive Ores and Concentrates	26	18	40	64	51	47	67
Other Nonferrous Metals:							
Ores and concentrates	84	65	77	77	100	111	141
Semi-processed	21	12	17	25	27	26	29
Total	105	77	94	102	127	137	170
Total nonferrous metals	2,109	1,824	1,940	2,710	3,286	2,801	3,165
Total merchandise exports	16,401	17,397	19,671	24,838	31,740	32,504	37,329
Nonferrous metal exports as a percentage of total exports	12.9	10.5	9.9	10.9	10.4	8.6	8.5

Source: Statistics Canada, *Exports - Merchandise Trade*, catalogue no. 65-202.

In terms of balance-of-payments effects, it is perhaps more appropriate to look at net exports rather than gross exports. Net exports of nonferrous metals are shown in table 2. Comparison of tables 1 and 2 reveals that net exports are more than 80 percent of gross exports in all years, averaging 85 percent.

Table 2

VALUES OF CANADIAN NET EXPORTS OF NONFERROUS METALS
($ Million)

	1970	1971	1972	1973	1974	1975	1976
Copper:							
Ores, concentrates and scrap	253	204	257	498	582	311	323
Semi-processed	432	343	355	449	557	421	453
Total	685	547	612	947	1,139	732	776
Nickel:							
Ores, concentrates and scrap	321	379	345	420	421	471	475
Semi-processed	389	268	244	306	346	320	322
Total	710	647	589	726	767	791	797
Zinc:							
Ores, concentrates and scrap	125	137	129	197	318	297	240
Semi-processed	90	78	120	192	216	202	261
Total	215	215	249	389	534	499	501
Other Nonferrous Metals:[a]							
Ores, concentrates and scrap	206	149	162	203	287	279	313
Semi-processed	67	23	24	38	-64	24	333
Total	263	172	186	241	223	203	646
Total nonferrous metals	1,873	1,581	1,636	2,303	2,663	2,325	2,720

Sources: Statistics Canada, *Exports - Merchandise Trade*, catalogue no. 65-202; Statistics Canada, *Imports - Merchandise Trade*, catalogue no. 65-203.

[a]Includes lead, precious metals, tin, radioactive metals, and other nonferrous metals.

Although tables 1 and 2 make it clear that the nonferrous metal mining industry has a major positive effect on the Canadian balance of payments, they should caution us not to expect the balance-of-payments effects of increasing the size of the industry to be spectacular. Even if the industry's exports rose by 50 percent, the resulting rise in total exports would be around 5 percent. And, as we saw earlier, there are a number of other factors which would tend to make the net balance-of-payments effect less than the initial effect of the increased exports.

To provide an additional perspective on the magnitude of Canada's exports of nonferrous metals, table 3 shows the major components of the Canadian balance of payments for the years 1967 through 1977. The balance on merchandise trade is the difference between the values of goods exported from and imported to Canada. The balance on nonmerchandise trade is the difference between exports and imports of services and income transfers, the main components being interest and dividends and tourism. The current account balance is the sum of the merchandise and nonmerchandise trade balances. The capital account balance includes all movements of capital into and out of Canada, and in recent years consisted chiefly of foreign purchases of Canadian bonds.

Table 3

THE CANADIAN BALANCE OF PAYMENTS, 1967-1977
($ Million)

	Merchandise Trade	Nonmerchandise Trade	Current Account	Capital Account	Total
1967	566	-1,065	- 499	519	20
1968	1,471	-1,568	- 97	446	349
1969	964	-1,881	- 917	982	65
1970	3,052	-1,946	1,106	424	1,530
1971	2,563	-2,132	431	346	777
1972	1,857	-2,243	- 386	605	219
1973	2,735	-2,627	108	- 575	- 467
1974	1,689	-3,202	-1,513	1,537	24
1975	- 534	-4,245	-4,779	4,374	- 405
1976	1,089	-5,276	-4,187	4,709	522
1977	2,907	-7,145	-4,238	2,817	-1,421

Source: Bank of Canada, *Bank of Canada Review* (May 1978).

The thing to observe about table 3 is that the major components of the balance of payments fluctuate substantially, and deficits and surpluses can be very large. For example, the current account deficit in the years 1975 through 1977 was substantially greater than Canada's total exports of nonferrous metals. Indeed, the *increase* in the nonmerchandise trade deficit between 1974 and 1977 was greater than those exports. Thus, although the nonferrous metal mining industry accounts for an important fraction of merchandise exports, it is not very powerful as an equilibrating item in the balance of payments.

The main body of the paper is divided into three sections. In the first, we provide a detailed examination of the balance-of-payments effects of two hypothetical nonferrous metal mines over their lifetimes. This provides a basis for the second section, in which the balance-of-payments effects of increasing the size of the industry are examined. Finally, in the third section, we examine how shifts in the balance of payments brought about by increasing the size of the nonferrous metal mining industry would affect the value of the Canadian dollar.

BALANCE-OF-PAYMENTS EFFECTS OF INDIVIDUAL MINES

In this section we examine the direct effects on the balance-of-payments of two individual mines which are assumed to be representative of new mines in Canada. There are two reasons for looking at individual mines. First of all, it is interesting to see how the balance-of-payments effects of individual mines vary over their lifetimes. More important, we want to see how a mine's direct impact on the balance of payments is related to the value of its exports, the major component of the direct effects.

Most of the data we use in this section are taken from a study by Mackenzie and Bilodeau, who analysed data on 124 potentially economic nonferrous metal deposits discovered in Canada, or being exploited, between 1951 and 1974. The two mines that we examine are two hypothetical mines which they suggest are typical.[1] In order to simplify interpretation of the figures, no allowance has been made for inflation.

The life of a typical mine may be broken into three stages. The first stage is the exploration stage. Following Mackenzie and Bilodeau, we assume that the exploration stage lasts eight years and involves expenditures of $2 million a year.[2] Obviously, this will vary widely from mine to mine. During the exploration stage the project has two effects on the balance of payments. We assume that all capital to finance the exploration is imported, at a real interest rate of 4 percent (which is equivalent to nominal rates of 10 to 12 percent with recent rates of inflation). Thus, there is a positive effect on the capital

1. Mackenzie and Bilodeau (1976).
2. Ibid., p. 36.

account equal to the amount of capital imported. Of course, much of the capital for exploration will in practice be supplied from Canadian sources. However, if the supply of foreign capital to Canada is perfectly elastic, all marginal borrowings implicitly come from abroad, and this is what we assume. Thus, even though a particular mining project may be financed from Canadian sources, it simply crowds out other borrowers, who are then forced to borrow abroad. This is perhaps a somewhat extreme assumption, but it avoids many difficulties. If the supply of foreign capital to Canada is not perfectly elastic, then borrowing in Canada will tend to raise Canadian interest rates and thus deter other Canadian firms from borrowing. Thus some other projects, probably outside the mining industry, will be displaced by the mining project's borrowing. These projects would have had balance-of-payments effects, but calculating them is all but impossible. It is simpler, and not unrealistic, to assume that the supply of foreign capital to Canada is perfectly elastic, so that an expansion of mining does not displace an expansion elsewhere.

The other balance-of-payments effect of a mine in the exploration stage is a negative effect on the current account because some of the exploration expenditures will go for imports of goods and services. Using the work of McCulla and Stahl, we assume that the proportion of imports of machinery, equipment, materials and supplies in total exploration expenditures is 5 percent.[3] Substantial variations in this figure would not change our results very much.

The second stage in the life of a typical mine is the development stage, during which the mine is brought into production. The balance-of-payments effects are the same as in the exploration stage: imports of capital have a positive impact on the capital account, and imports of goods and services have a negative impact on the current account. We assume that 10 percent of development expenditures go for imports.

The third stage in the life of a typical mine is the production stage, which lasts until the orebody is exhausted or becomes uneconomical to mine further. During this stage the capital which was imported earlier is repaid, with interest at 4 percent. This has a negative impact on the balance of payments. So do imports of machinery and other intermediate goods, which we assume are equal to 5 percent of operating costs. On the positive side, the mine is now producing ore, all of which is assumed to be exported. This assumption makes sense if Canada faces fixed world prices, since if additional production is not exported, Canadian

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3. McCulla and Stahl (1975). This work is based on the 1961-1966 Input-Output tables published by Statistics Canada. Figures on page 11 indicate that the tradable (non-labour) component of expenditure on inputs by the nonferrous metal mining industry is somewhere between 24 and 76 percent of expenditure. Of this only 7 percent is spent on imports. Hence, between 1.7 percent and 5.3 percent of total input expenditure leaves the country. We will use 5 percent to be conservative.

consumption must increase, which would require lower domestic prices (assuming no change in domestic demand). We assume that the ore is exported in unrefined form for two reasons. First, a study by Wilkinson suggests that recent expansion of Canada's resource exports has chiefly involved exports of ores and concentrates.[4] Second, to assume otherwise would require us to examine the balance-of-payments effects of expanding the Canadian smelting and refining industry as well as the extractive industry.

Mine #1

The data for this hypothetical mine are taken from Mackenzie and Bilodeau.[5] This particular mine involves production in two stages, an open-pit operation which operates for two years and an underground operation which operates for seven and a half years. The open-pit mine extracts 300,000 tons of ore per year, containing 0.31 percent copper, 3.98 percent zinc, 0.63 ounces of silver per ton, and 0.032 ounces of gold per ton. The underground mine extracts 300,000 tons of ore in each of the first seven years and 140,000 tons in the last year of its operation, containing 1.65 percent copper, 2.16 percent zinc, 0.95 ounces of silver per ton, and 0.015 ounces of gold per ton. It is assumed that refined copper sells for 75¢ a pound, with a net smelter return of 65 percent of the market price, zinc sells for 40¢ a pound, with a net smelter return of 47 percent, silver sells for $4 an ounce, while a net smelter return of 85 percent, and gold sells for $170 an ounce, with a net smelter return of 85 percent.[6]

The (direct) balance-of-payments effects of mine #1 over its lifetime are shown in table 4. These of course vary dramatically depending on the stage the mine is in. On average, the mine has a direct balance of payments effect of $2,330,000 per year, which is roughly 76 percent of its average exports of $3,074,000. These figures may somewhat understate the export revenue for the mine, since we have used net smelter returns to value production. Even if the ore is not smelted in Canada, other Canadian inputs (such as transportation) will presumably be added before it actually leaves the country, so that what is exported will have a higher value than we have used here.

Mine #2

The second hypothetical mine is a much larger and more profitable operation than the first. Data for it were also taken from Mackenzie and Bilodeau.[7] This mine also involves production in two stages. In the first, which lasts five years, ore

4. Wilkinson (1978).
5. Mackenzie and Bilodeau (1977) volume 2, pp. 192-4.
6. These price and net smelter returns are identical to those of Mackenzie and Bilodeau (1976) p. 112.
7. Ibid., pp. 113-5.

Table 4

BALANCE-OF-PAYMENTS EFFECTS OF MINE #1
($ Thousand)

Year	Net Flow of Interest and Capital	Imports	Exports	Net Effect
1	2,000	100		1,900
2	2,000	100		1,900
3	2,000	100		1,900
4	2,000	100		1,900
5	2,000	100		1,900
6	2,000	100		1,900
7	2,000	100		1,900
8	2,000	100		1,900
9	4,700	470		4,465
10	5,500	550		5,225
11	-3,738	131	5,217	1,348
12	-3,738	131	5,217	1,348
13	-3,738	217	6,836	2,881
14	-3,738	217	6,836	2,881
15	-3,738	217	6,836	2,881
16	-3,738	217	6,836	2,881
17	-3,738	217	6,836	2,881
18	-3,738	217	6,836	2,881
19	-3,738	217	6,836	2,881
20	-3,738	102	3,190	- 650
Average	- 559	185	3,074	2,330

containing 1.66 percent copper is extracted at a rate of 1,800,000 tons per year. In the second, which requires additional development capital expenditure and lasts ten years, ore containing 1.58 percent copper is extracted at the same rate. The assumed price of copper is again 75¢ per pound with a net smelter return of 65 percent.

The (direct) balance of payments effects of mine #2 over its lifetime are shown in table 5. On average, the mine's effect on the balance of payments is $14,554,000 per year, which is roughly 91 percent of its average exports of $16,072,000.

It is possible to argue that, for purposes of this study, one should not include exploration costs, since there exist many potential mines which have been discovered but not exploited. If government treatment of the mining industry became more favourable, these would presumably be the first to be brought into production. This argument is surely valid in the short term, although not in the long term.

Table 5

BALANCE-OF-PAYMENTS EFFECTS OF MINE #2

($ Thousand)

Year	Net Flow of Interest and Capital	Imports	Exports	Net Effect
1	2,000	100		1,900
2	2,000	100		1,900
3	2,000	100		1,900
4	2,000	100		1,900
5	2,000	100		1,900
6	2,000	100		1,900
7	2,000	100		1,900
8	2,000	100		1,900
9	17,500	1,750		16,625
10	17,500	1,750		16,625
11	- 5,004	485	27,676	22,187
12	- 5,004	485	27,676	22,187
13	- 5,004	1,053	27,676	21,920
14	- 5,004	1,053	27,676	21,920
15	- 5,004	1,053	27,676	21,920
16	- 5,004	548	26,343	20,791
17	- 5,004	548	26,343	20,791
18	- 5,004	548	26,343	20,791
19	- 5,004	548	26,343	20,791
20	- 5,004	548	26,343	20,791
21	- 5,004	548	26,343	20,791
22	- 5,004	548	26,343	20,791
23	- 5,004	548	26,343	20,791
24	- 5,004	548	26,343	20,791
25	- 5,004	548	26,343	20,791
Average	- 962	556	16,072	14,554

For purposes of comparison, we did look at one mine which falls into the category of discovered but not currently economical.[8] As one might expect, its effect on the balance of payments is very high relative to its exports (over 90 percent), because there are no exploration costs to be funded with borrowed money. Nevertheless, on the basis of the two mines we have looked at, it does not seem unreasonable to conclude that, in general, the direct balance-of-payments effect will be between 75 and 95 percent of exports.

8. Gagnon (1977) and *Northern Miner* (June 29, 1978) p. 18.

The figures given in tables 4 and 5 should be treated as purely illustrative. Obviously, the direct balance-of-payments effects of different mines will vary substantially. In principle, these effects could be calculated for any existing or projected mine, and such an exercise might well be worth doing if the government were contemplating taking some action which would have the effect of expanding the mining industry. For our purposes, all that is needed is the rough estimate that, in general, the direct balance-of-payments effects of a mine will probably be between 75 and 95 percent of the value of production, where both are averaged over its lifetime.

BALANCE-OF-PAYMENTS EFFECTS OF INCREASING THE SIZE OF THE INDUSTRY

We are now in a position to estimate the balance-of-payments effects of increasing the size of the nonferrous metal mining industry in the long term. Let us suppose that the industry increased in size so as to export an additional $300 million worth of ore and concentrates annually; this would be an increase of roughly 10 percent over 1975-76 levels. The direct effect on the balance of payments would be $300x$ where x is probably somewhere between 0.75 and 0.95.

As we indicated earlier, however, there will also be indirect effects, which will work in the opposite direction. If the multiplier is μ and the marginal propensity to import is m, we would expect national income to increase by $300\mu x$ and hence imports to increase by $300m\mu x$. Thus the final impact on the balance of payments will be

$$300x - 300m\mu x. \qquad (1)$$

We must now provide values for x, m and μ. We have already suggested that x is between 0.75 and 0.95. The marginal propensity to import, for Canada, is frequently taken to be around 0.2; we can safely assume that it is between 0.15 and 0.25. The multiplier for Canada is frequently taken to be slightly less than 2.0; we can probably assume that it is between 1.3 and 2.3, although one could argue that it is larger in this case if extra mining activity leads to higher government expenditures.[9]

The estimates of x, m and μ which will give the largest value to expression (1) are $x = 0.95$, $m = 0.15$ and $\mu = 1.3$. Using these values, the final annual impact on the balance of payments would be $229 million. The estimates of x, m and μ which will give the smallest value to expression (1) are $x = 0.75$, $m = 0.25$ and $\mu = 2.3$. Using these values, the final annual impact on the balance of payments

9. McCulla and Stahl (1975) give a multiplier for nonferrous metal ores and concentrates of 1.50. This multiplier is comparable to $x\mu$ in our notation. The middle of our range of estimates for x is 0.85, and the middle of our range of estimates for μ is 1.8; using these values, $x\mu$ is 1.53, which is very close to the figure arrived at independently by McCulla and Stahl.

would be only $96 million. This figure is clearly too low, partly because if the marginal propensity to import is as high as 0.25, the multiplier will not be as high as 2.3. Finally, the mean values, $x = 0.85$, $m = 0.2$ and $\mu = 1.8$, imply a final impact on the balance of payments of $163 million. This is just over half the value of the additional exports.

An increase in exports of $300 million per year would require a substantial increase in the size of the industry in the long run. We looked at a random sample of nonferrous metal mines (excluding the Kidd Creek mine, which was deemed to be exceptional) and found that, at the prices we assumed in the last section, the average revenue of those mines was $18.6 million per year. Data were taken from the Canadian Minerals Yearbook, 1975, and refer to mines producing in that year.[10] Thus, in order to export an additional $300 million a year in ore and concentrates, sixteen new mines of average size would be required.

A major expansion of the nonferrous metal mining industry might lead to increased exports of $1 billion a year. This would require fifty-four new mines. Using average values for the parameters of (1), the total balance of payments effects would be $544 million a year. Using the most favourable values for the parameters of (1), they would be $765 million a year.

THE BALANCE-OF-PAYMENTS AND THE EXCHANGE RATE

So far, we have talked about effects on the balance-of-payments as if it were actually possible to change the balance-of-payments in the long run. This of course is not true in a world of flexible exchange rates (or, indeed, in any world where exchange rates respond to market forces). Canada cannot run a persistent surplus on the balance-of-payments unless Canadians are willing to hold an increasing stock of foreign currencies and gold, and she cannot run a persistent deficit unless foreigners are willing to hold an increasing stock of Canadian currency. It thus seems reasonable to assert that, in the long term and on the average, Canada's balance of payments must be in balance. This does not mean that some real event, such as the opening of a new mine, will not affect the balance of payments. What it does mean, however, is that in the long term the Canadian dollar will have to change in value, causing other components of exports and imports to change, so that eventually the balance of payments is in balance again at a new value of the exchange rate. Thus we could just as well speak about the exchange rate effects of an increase in the size of the Canadian nonferrous metal mining industry as we could about the balance-of-payments effects of such an increase. In this section, we consider what the balance-of-payments effects estimated

10. Canada, Energy, Mines and Resources (1978) pp. 171-80, 213-7, 277-80, 464-70, 578-83.

in the last section would imply for the exchange rate.[11]

We now analyse formally the relationship between an exogenous shift in the balance of payments and the exchange rate. Let P denote the value of the Canadian dollar in terms of U.S. dollars. Let E(P) be the demand function for Canadian exports, expressed in U.S. dollars, as a function of the exchange rate, P, where all other variables are held constant. Similarly, let M(P) be the Canadian demand function for imports, expressed in U.S. dollars, as a function of P. Let E'(P) and M'(P) represent the first derivatives of E(P) and M(P) respectively; that is, E'(P) is the change in exports for a small change in the exchange rate, and M'(P) is the change in imports for a small change in the exchange rate. M'(P) will surely be positive: as the Canadian dollar becomes more valuable, imports become cheaper, and so we import more. The sign of E'(P) is not so clear: as the Canadian dollar becomes more valuable, our exports become more expensive, and so tend to decline, but their value may still rise when expressed in U.S. dollars.

In the long term,

$$E(P) - M(P) = -K \qquad (2)$$

where K is the balance on capital account, which is assumed to be exogenous.[12] Thus we are saying that exports minus imports, the balance on the current account (if exports and imports are defined broadly to include services and income transfers), must equal minus the balance on the capital account for the balance of payments to be in equilibrium. Now suppose that there is some exogenous shift in the balance of payments, of amount dX. If the balance of payments is to return to equilibrium, it must be the case that

$$dX + E'(P)\,dP - M'(P)\,dP = 0, \qquad (3)$$

where dP is the resulting change in the exchange rate. Using equation (3) to solve for dP, we find that

$$dP = dX / [M'(P) - E'(P)]. \qquad (4)$$

Equation (4) can be used to find the effect on the exchange rate of any exogenous shift in the balance of payments, represented here by dX. It is merely necessary to plug in estimates of M'(P) and E'(P). Note that the larger M'(P) is and the smaller E'(P) is, the smaller will be the change in the exchange rate.

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11. In this analysis, we ignore all second-round effects. For example, if increased exports by the mining industry caused the exchange rate to rise, that would make mining less profitable and would tend to reduce the size of the industry. Also, increases in the size of the mining industry might change factor prices, and those changes might in turn affect the level of mining activity. We do not consider this type of impact here.
12. Here the balance on capital account refers to the balance on capital account exclusive of capital flows due to new mine development, which are included in dX in (3). Of course, the balance on capital account is not really exogenous, but we are not trying to explain it for the purposes of this exercise.

Thus if Canada's exports and imports respond strongly to a change in the exchange rate, only a small change will be needed to bring the balance of payments back into equilibrium. On the other hand, if the response of exports and imports to a change in the exchange rate is weak, a large change will be needed. Note that if exports respond strongly to exchange rate changes, E'(P) will be large in magnitude but negative.

We can estimate M'(P) and E'(P) very simply from published estimates of elasticities in international trade. By simple manipulation of the formulae defining elasticities, we have

$$M'(P) = \varepsilon_M \, M/P \qquad (5)$$

and

$$E'(P) = (\varepsilon_X + 1)E/P \qquad (6)$$

where ε_M and ε_X are the conventionally measured (and therefore negative) elasticities of demand for imports and exports respectively. Stern *et al* review a number of studies of import and export demand elasticities for Canada.[13] The import elasticities range from -0.60 to -1.59, with a median of -1.30, and the export elasticities range from -0.23 to -1.95, with a median of -0.79.

In 1976, total exports (including non-merchandise exports) were approximately $46 billion, and total imports (including non-merchandise imports) were approximately $48 billion. Thus, evaluated at the median estimated elasticities, and taking P to be unity, M'(P) is $62.4 billion and E'(P) is $9.7 billion. Hence, from (4),

$$dP = 0.019 \, dX. \qquad (7)$$

Thus a $1 billion positive shift in the balance of payments — which is larger than one could reasonably expect from an expansion of nonferrous mining activity — would increase the exchange rate by 1.9 cents.

Of course, if elasticities of demand were lower, the change in the exchange rate would be greater. If ε_M were -1.0 and ε_X were -0.5, which are rather low estimates for these elasticities, a $1 billion positive shift in the balance of payments would increase the exchange rate by 4.0 cents. This would seem to be the highest reasonable estimate of the exchange rate impact of the balance-of-payments shift.

In the last section, we saw that a moderate increase in nonferrous metal exports of $300 million might lead to a balance of payments shift of $163 million. Using (7), this would raise the exchange rate by 0.31 cents. A large increase of $1 billion would lead to a balance-of-payments shift of $544 million. Using (7), this would raise the exchange rate by 1.03 cents.

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13. Stern, Francis and Schumacher (1976) p. 14.

CONCLUSION

The nonferrous metal mining industry has a significant effect on Canada's balance of payments. However, it appears that even a substantial increase in this size of this industry is unlikely to improve the balance of payments by much more than $0.5 billion a year, or, equivalently, raise the value of the Canadian dollar by much more than a cent.

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CORPORATE PERSPECTIVES ON THE FURTHER PROCESSING OF MINERALS IN CANADA

by

A.G. Balogh

For the purposes of this brief overview, my remarks will be restricted to the non-ferrous metals industry. Further processing to primary metal is generally not regarded to be an issue for aluminum, nickel, or iron and steel, so a further narrowing of the discussion to copper, zinc and lead can conveniently be made.

In Canada today, metal refining capacity expressed as a percentage of mine capacity is about 75 percent for copper, 50 percent for zinc and 60 percent for lead. This is a relatively good balance of domestic processing and export of concentrates. A substantial portion (30 percent to 40 percent) of refined metal is consumed domestically. However, in B.C. only 10 percent of copper production is processed, and in the Atlantic provinces zinc minerals are not processed to metal at all.

Concentrate production from Canadian mines available for export in 1978 will likely be as follows:
300,000 tons copper in concentrate
625,000 tons zinc in concentrate
90,000 tons lead in concentrate.

Two-thirds of Canadian copper concentrate will find its way to Japanese markets and about the same proportion of zinc concentrate exports will be shipped to European smelters.

A more detailed regional analysis of the mine production indicates that there is obviously more scope for copper metal production in British Columbia, for zinc metal production in New Brunswick or the Yukon, and in the north-west for lead metal.

EXISTING SMELTING CAPACITY

Late 1977 and early 1978 began to see the full effects of a long period of depressed copper prices, through mine closings and reduced mine production. As a result custom smelters are increasingly short of feed, and are cutting prices on short-term contracts in order to attract supplies. Profit margins in the smelting and refining sectors are decreasing.

Generalizations about the future of the copper concentrate market must be made cautiously. While some new concentrate supplies (e.g. from Mexico, Burma, Latin America, Philippines and Morroco) are expected to come on stream, other units are vulnerable, such as Granduc, Craigmont and Gibraltar, and Mt. Lyell in Australia. Overall however the outlook is for continuing worldwide excess of copper smelting capacity and shortage of custom concentrate well into 1979 and perhaps longer. Since a decision to process at or near the mine is based on the ability to smelt more cheaply than in other facilities, the short-term prospects for new additional Canadian smelting facilities would not appear to be encouraging.

Approximately 25 percent of the western world's zinc smelting capacity, about 1.5 million tons, is now idle. Because of seriously depressed levels of zinc consumption now and forcast at least into the mid-eighties, new zinc plants will be at a serious disadvantage in competing for world markets. Higher capacity utilization with low incremental production costs give existing plants a significant competitive advantage.

NEW SMELTING CAPACITY

Capital costs for minimum economic copper smelting and refining capacity have escalated to about $3,000 per annual ton of capacity. To obtain a very minimum return on this capital over twenty years, together with operating costs and allowance for taxes, will require a charge of 40¢ to 45¢ against each pound of throughput. Currently, Japanese treatment charges are being quoted at less than 20¢ per pound. A new facility is clearly uncompetitive on a purely commercial basis. It is also evident that, with current metal market conditions, mines cannot support further processing.

A similar scenario can be drawn for zinc where $1,500 of investment is required for each new ton of annual refining capacity. A charge of about 25¢ per pound of zinc would be needed to justify building and operating a zinc reduction plant. This is for refining alone and assumes reasonable power costs. With today's European

metal price at US 28.35¢ per pound, there is not much left to cover mining and marketing costs.

The case for lead is not unlike that of both copper and zinc.

Apparently, ordinary economics indicate that new smelting capacity is not justified either in the short or the medium term. What then are some of the factors which may work against ordinary economics?

Before deciding to build a 'green field' smelter in Canada, some important elements which must be considered are:

i) *Expected rate of return.* In view of the high capital cost of new facilities in relation to costs at existing smelters, is the profit potential sufficient to support the investment?

ii) *Price forecasts.* Forecasting world supply and demand relationships for copper and zinc is a hazardous exercise at best. Today's inflationary economics and rapidly shifting trends in consumption make predictions far more difficult. Five-year forecasts currently vary from slow improvement to downright gloom.

iii) *Availability of raw material.* Long term availability of *quality* concentrate must be assured for the life of a smelter project.

iv) *Labour and energy costs.* Manpower and fossil fuels or electricity represent at least two-thirds, and perhaps as much as 80 percent, of the cost of operating nonferrous reduction plants. Canada will have a temporary advantage in labour costs while the dollar value remains below foreign currencies. Energy costs are, on the other hand, likely to escalate further as governments become increasingly reluctant to provide low cost fuel or hydroelectric power to heavy consumers.

v) *Availability of markets and transportation costs* for metals and concentrates, and for byproduct acid and/or fertilizers.

vi) *Government regulations.* Disputes between various levels of government in tax sharing, transportation, environmental standards, etc., could jeopardize project economics.

vii) *Public attitudes.* Is the public supportive because of employment opportunities or antagonistic as a result of environmental concerns? What political reactions and governmental regulations will result?

viii) *Economic nationalism.* Export of raw materials from the developing countries draws negative reactions because of unfavourable current perceptions relating to the image of 'hewers of wood and drawers of water.' Canadian attitudes

are not unlike those of developing countries, though the image is not really appropriate.

Public attitudes and economic nationalism emerge as perhaps the most important forces directing us away from the real economics of mineral processing. Further comment is worthwhile.

The location of facilities through the operation of free market economics is being tempered by regional, provincial or national political desires for domestic processing. Financial assistance is often available for construction in order to increase employment and domestic productivity, to generate secondary industries or to increase value in terms of foreign exchange.

Developing countries have 70 percent of the world's population but only 10 percent of the world's resource consumption and 7 percent of world industry. Facing severe pressures from rising populations and increasing poverty, many of these countries are adopting strategies which emphasize processing of raw materials with capital-intensive technology. Some, like Korea and Brazil, seek to attract concentrate for smelting and refining based on a substantial domestic consumption without a meaningful mine production. Precedents for this approach are found in Germany and Japan.

Japan provides the most dramatic modern example. Business and industry were encouraged and guided by the Ministry of International Trade and Inudstry and other branches of government. They concentrated on large-scale capital-intensive industry which offered the greatest potential for overall gains in national productivity. Copper smelting was deemed to qualify and was assisted by tariff and nontariff protection to limit copper metal imports. This permitted the domestic copper price to be established above prices prevailing in other world markets. With such support, the Japanese expanded their facilities and competed aggressively for long-term supplies for new mine sources. In doing so they stimulated the development of copper mines, particularly in the Pacific Rim area including British Columbia. In Japan today, if we discount the economic slump, smelter pollution controls are possibly the major reason for curtailment of new expansions in copper and zinc, as markets for sulphuric acid currently limit smelter production.

Public support for processing raw materials can usually be aroused through reports about the effects on such things as employment, taxes, and balance of payments. The direct impact on employment of a new smelter or refinery is relatively easy to estimate, but the indirect impact or multiplier effect is much more elusive. Jobs created by suppliers and services to the industry, in addition to forward-linked manufacturing, are very difficult to measure. The concept of the multiplier originated in the Keynesian macroeconomic literature to relate changes in direct employment from investment to total employment after indirect effects were considered. It has been applied to measure the impact of the mining industry and a variety of

methods have been used to calculate the multipliers. The results range from 1.74 to 7.0, ample spread to serve the purposes of rationalization for, or against, mineral processing.

The number of direct jobs created by a modern copper smelter-refinery producing 100,000 tons of copper annually is 450 and the total capital required per job is more than $600,000. The comparable figures for a zinc smelter are 400 jobs and $375,000 per job. A report on value added at different levels of an integrated copper industry was recently prepared for a senate inquiry on U.S.-Canadian relations. Some of its conclusions follow, and tables 1 to 4 show the assumptions and calculations used.

> Calculations regarding the value added at various stages of the copper processing chain can vary widely depending on assumptions regarding the price of the metal and what final product is produced. Thus, it is possible to vary these assumptions and prove almost anything.
>
> In these calculations, a copper price of $1.00 per pound has been assumed. This is considerably more than the present level (although considerably less than the high in 1974). The $1.00 price was used simply because it is the level that would be needed to justify the investment figures shown as being required for new mining, smelting and refining capacity.
>
> Figures for value added in manufacturing are actual figures prevailing in today's markets. However, it should be noted that the scale of plant assumed simply would not be built in Canada, as the production levels would be far in excess of domestic requirements for the products involved.
>
> Given these assumptions, the proportion of value added at the various stages varies widely with the final product.
>
> Certain other conclusions are obvious and not particularly surprising:
>
> i) Fixed capital required per employee tends to decrease with the stages of processing, while working capital requirements per employee tend to increase. In total, however, capital required per employee is greatest at the primary end of the chain.
>
> ii) Conversely, *value added per employee tends to decrease with the stage of processing*. Given the structure of our wage rates, this has implications for the competitive position of fabricating industries in Canada. Empirical evidence also suggests that the higher the value added per employee, the more likely the venture is to be successful in a Canadian context.

Table 1

PERCENT OF TOTAL VALUE ADDED

	Mining and Concentrating	Smelting and Refining	Manufacturing
Rod	74	24	2
Tube	58	19	23
Building Wire	44	15	41

Table 2

VALUE ADDED AT DIFFERENT LEVELS OF AN INTEGRATED COPPER INDUSTRY
(Percent)

	Wages Paid	Value Added
Value Added Through Manufactured Products		
Mining and concentrating	29	24
Smelting and refining	10	10
Rod mills	2	2
Wire and cable	59	64
Total	100	100
Value Added Through Prime Metal		
Mining and concentrating	74	71
Smelting and refining	26	29
Total	100	100

Source: Task Force on Upgrading, *Report*, (Ottawa: Industry, Trade and Commerce, 1974).

COPPER SMELTING IN BRITISH COLUMBIA

The debate over a copper smelter and refinery in British Columbia is illustrative of the various forces influencing further processing. A 1975 report by the B.C. copper task force noted that the province is the world's largest exporter of copper concentrate and is not realising the potential benefits from its production. They recommend that either the government or the private sector should build two smelter/refineries totalling 275,000 TPY in metal capacity.

These and a series of other recommendations were made without a full investigation of economic forces which produced the situation. The task force apparently believed that the causes were largely political and institutional.

The task force also recognized that while 'manufacture of finished copper production holds the greatest potential for adding value to the copper resources of B.C., it also entails the greatest difficulty in terms of market development.' They argued for investment in copper smelters and refineries while admitting that they account for little value added or employment. They justified recommendations by claiming that stumbling blocks to secondary processing or manufacturing may be overcome through negotiations with Japan.

A major smelting-refining complex has not been built in British Columbia. At least until 1975, Japanese industry made it very attractive for Canada to export con-

Table 3

CAPITAL REQUIRED, DIRECT EMPLOYMENT CREATED, AND VALUE ADDED AT DIFFERENT LEVELS OF AN INTEGRATED COPPER INDUSTRY PRODUCING WIRE AND CABLE

	Mining and Concentrating	Smelting and Refining	Rod Mill	Wire and Cable	Total
Capital Required ($ Million)					
Fixed assets	300	250	15	190	755
Working capital	20	30	15	110	175
Total	320	280	30	300	930
Employees Required	1,200	450	50	2,500	4,200
Value Added					
Per pound copper ($)	0.74	0.25	0.02	.069	1.71
Per year ($ Million)	150	50	4	138	342
Per Employee ($)					
Fixed capital	250,000	556,000	300,000	76,000	180,000
Working capital	17,000	67,000	300,000	44,000	42,000
Total Capital	267,000	623,000	600,000	120,000	222,000
Value added per year	125,000	111,000	80,000	56,000	81,000
Through Rod					
Percent of capital required	51	44	5	-	100
Percent of employees	71	26	3	-	100
Percent of value added	74	24	2	-	100
Through Wire and Cable					
Percent of capital required	35	30	3	32	100
Percent of employees	29	11	1	59	100
Percent of value added	44	15	1	40	100

Source: Estimates by Noranda Group companies.

Note: The above assumes development of two typical British Columbia open pit mines each producing 50,000 tons of copper in concentrate per year, integrated with a smelter plus refinery capable of producing 100,000 tons of metal per year. All of the metal would then be rolled into rod which would then all be drawn into building wire. Capital costs are estimated in unescalated 1976 dollars and a copper price of $1.00 per pound is assumed.

Table 4

CAPITAL REQUIRED, DIRECT EMPLOYMENT CREATED, AND VALUE ADDED AT DIFFERENT LEVELS OF AN INTEGRATED COPPER INDUSTRY PRODUCING TUBE

	Mining and Concentrating	Smelting and Refining	Tube Mill	Total
Capital Required ($ Million)				
Fixed assets	300	250	160	710
Working capital	20	30	90	140
Total	320	280	250	850
Employees Required	1,200	450	1,400	3,050
Value Added				
Per pound copper ($)	0.75	0.25	0.30	1.30
Per year ($ Million)	150	50	60	260
Per Employee ($)				
Fixed capital	250,000	556,000	114,000	233,000
Working capital	17,000	67,000	64,000	46,000
Total capital	267,000	623,000	178,000	279,000
Value added per year	125,000	111,000	43,000	85,000
Through Sheet or Tube				
Percent of capital required	38	33	28	100
Percent of employees	39	15	46	100
Percent of value added	58	19	23	100

Source: Estimated by Noranda Group companies.

Note: Assumptions are as in table 3 except that the copper metal is converted into tube.

centrates rather than refined metal, and B.C. copper producers benefited. Economic forces prevailed and the mining industry grew more rapidly and profitably than would have otherwise been the case.

Some observers believe that market and social factors in Japan are changing. With an economy no longer expanding at rates which prevailed in recent years, there will no longer be such a pressing need to attract feedstock. Japan has an established copper smelting industry and there is a growing aversion to heavy industrial expansion with costly and often unreliable pollution control equipment. All of this, together with foreign exchange factors, should eventually force treatment charges to higher levels in Japan, making it a less attractive market for B.C. concentrate producers.

ZINC PROCESSING IN NEW BRUNSWICK

Governments in countries with important zinc mineral reserves are being pressed to establish new or expanded metal processing facilities. Ireland, Mexico, Peru, Argentina, South Africa and Thailand all have sufficient resources to feed a zinc reduction plant. The United States is also anxious to reduce its dependence on zinc metal imports, and has smelters under construction or on the drawing boards. World metal production capacity is already 1.5 million short tons in excess of current consumption, which is about 4.75 million short tons.

The situation in New Brunswick is not dissimilar, with provincial and federal governments both anxious to see a zinc reduction plant built there. With one of the world's largest zinc mines within its borders, it seems likely that such a project will eventually become a reality. However, a zinc smelter in New Brunswick will be viable only with a complete change in price and market conditions.

CLOSING REMARKS

While economic factors, such as metal prices, metal markets, transportation costs and energy costs are shifting, hopefully towards real justification for further processing, the Canadian mining industry must remain healthy and profitable. Objectives must be established to maintain our present share of the world's mineral markets. The task, which begins with a major exploration effort, is a formidable one. Despite forecasts of slower world-wide growth, demand for Canadian nonferrous mineral products will increase substantially (see table 5).

Table 5

PROJECTED WORLD CONSUMPTION OF SELECTED METALS TO 2000

Metal	1977 World Consumption (Thousand Metric Tons)	2000 World Consumption (Thousand Metric Tons)	Increase (Percent)
Copper	9,018	17,190	91
Zinc	5,687	13,409	135
Nickel	634	2,500	294
Lead	4,432	12,106	173

Sources: For 1977 consumption: *World Metal Statistics* (April 1978). For consumption in 2000: Stanford Research Institute, *World Metals Availability* (March 1976).

If we assume that Canada holds its present share of world markets, and if we adjust the volumes to reflect depletion of existing Canadian mines between now and the year 2000, the *new* annual production required in Canada in the next 22 years will be:

Copper	1,100,000 metric tons
Zinc	2,600,000 metric tons
Nickel	700,000 metric tons
Lead	800,000 metric tons

In every case, new production required is far in excess of *actual* 1977 Canadian production:

Copper	785,000 metric tons
Zinc	1,305,000 metric tons
Nickel	232,000 metric tons
Lead	326,000 metric tons

The message is clear. If, in our preoccupations with primary processing and manufacturing, we neglect exploration and mining efforts, the Canadian mineral industry will lose its position as a major factor in international markets. Today we can still claim that Canadians are unexcelled in mining and smelting technologies. Consider for example Cominco's lead and zinc metallurgical complexes, Inco's nickel reduction plants, Noranda's new and innovative copper smelting process, Stelco's efficient iron and steel plants: all have world-wide reputations. There are, of course, other examples of an industry which grew healthy in a free market environment. Permitted to continue operating profitably with incentives sufficient to justify risks, the Canadian mineral industry will stay healthy and ready to build primary and secondary processing plants when markets and prices are favourable.

Development of the mineral sector should be directed towards maximizing opportunities within the various regions of Canada. Mineral dependent communities should not be allowed to fall into economic depression but, at the same time, these considerations must not result in Canadians becoming less competitive in world markets. Negotiation of reduction in foreign trade barriers which discourage the processing of Canadian raw materials prior to export should be supported.

Maximum benefits will be realized from Canada's national resources through further processing, but as long as foreign markets exist for less-processed goods, efforts should be directed to maximizing export revenues and thereby stimulating the mineral industry as a whole.

CANADIAN RESOURCE MANAGEMENT AND THE NORTH-SOUTH DIALOGUE

by

W.G. Chambers
and
J.S. Reid

INTRODUCTION

The new international economic order, in dealing with issues of natural resource management, has polarized countries into two broad categories - the north and the south. The south is for the most part the resource-abundant developing countries of the third world. The north comprises the industrialized economies of the USA, the EEC, other western European countries, Japan, Canada, Australia, the Republic of South Africa, and New Zealand.

The perception by many nations that Canada, Australia, South Africa and New Zealand form an integral part of the north is clearly misleading. That perception overlooks the special characteristics of these countries — characteristics which place them in a kind of penumbra region within the north-south dialogue. Australia, Canada, the Republic of South Africa and New Zealand can be said to be in a penumbra region because, though highly industrialized and importers of certain natural resources, each remains greatly dependent on commodity exports for economic prosperity. Thus, while these penumbra countries do share some of the concerns and problems of the highly industrialized resource deficient economies, they are also haunted by many of the perennial resource management problems which plague third world countries. Not surprisingly therefore, strategies which aim

at linking and harmonizing the resource development priorities of the resource deficient highly industrialized economies could adversely affect economic growth and development of penumbra countries. Consequently, the resource management problems of the penumbra countries are indeed unique and as such demand special consideration in the north-south dialogue.

This paper attempts to suggest a range of possible resource management strategies, relating primarily to nonfuel minerals, for the consideration of Canadian resource managers seeking to respond to the challenges posed by the north-south dialogue. The development of such strategies calls for an assessment of the impact on Canada of the emerging resource management strategies of both industrially advanced countries and third world resource-abundant countries.

In order to appreciate fully how the resource management strategies of the third world and the industrially advanced economies complement each other and constrain the activities of penumbra countries, it is expedient to analyze national, regional, and international measures employed by the two polar groups (the north and the south) to attain their resource policy objectives.

INDUSTRIALIZED RESOURCE DEFICIENT COUNTRIES (THE NORTH)

The economies of Japan, EEC countries and the USA share to varying degrees — 90, 75, and 15 percent respectively — a high measure of external dependence on imports of raw materials. Recent developments such as the actions of OPEC, nationalization of the assets of mining companies both in the third world and in developed economies, growth in the number of producer associations, and the insistence of many nation states upon greater equity participation and control in resource industries have heightened the apprehension of all resource-deficient countries over the issue of security of supply. Consequently, it is not surprising that Japan, the EEC, and the USA share a common resource management objective: that of *developing secure, adequate, and diverse sources of supply of natural resources* at reasonable prices.

The main factors which dictate the courses of action taken by each country to meet its resource requirements are the country's economic structure and emerging industrial strategy, its international political and economic obligations, and the maintenance of national security. For example, the USA's resource management policy (discussed below), in its endeavours to minimize the costs of supply interruptions, not only take into account national security but also explicitly recognize its international political and economic responsibilities arising out of its hegemonic position in the west.

The general approaches followed and the specific instruments employed to ensure security of supply vary considerably among industrialized economies. This fact

will be illustrated by examining the resource management strategies of France, the USA, Japan and the Federal Republic of Germany.

France

France's resource management strategies focus largely on that country's basic resource problems. Briefly, these are: the near absence of domestic sources of supply of nonferrous minerals; a generally declining mineral industry; a high degree of dependence on foreign sources of energy supply; and the decline of French political and economic influence on its former colonial territories. In response to these problems, France has undertaken a set of initiatives to provide its resource needs.

One of the first of these initiatives was the transformation of public service organizations into private sector activities in mining and related fields. The most important of these organizations is the Bureau de Recherches Géologiques et Minières (BRGM) and its overseas subsidiary holding company, Société d'Etudes de Recherches et d'Exploration Minières (SEREM).[1] These organizations, by providing technical, scientific, and managerial expertise at the exploration and mining stages, have secured equity in a number of mining projects throughout the world. The BRGM has used its retained earnings from these equity participations to extend its overseas mining portfolios. Moreover, to make BRGM a more attractive business partner, the French government provides certain financial advantages to private companies which enlist BRGM's participation in mining ventures. At present the BRGM and SEREM boast investment in French Guiana, Upper Volta, New Caledonia, Zaire, Australia, Brazil, Canada, and in many other countries.

In seeking to diversify the country's external sources of energy supply, the French government offers special incentives to both public and private French oil companies.[2] Concurrently, the government encourages the development of off-shore oil deposits, as well as non-oil domestic sources of energy, including nuclear, thermal and geothermal. Aside from these undertakings, the French government's pro-Arab policy is clearly designed to ensure access to Middle East oil.

Other far-reaching measures undertaken by the French are raw material stockpiling,[3] special tax concessions to resource companies, and the operation of an overseas investment insurance scheme.

1. SEREM and SOQUEM (Société Québécoise d'Exploration Minère) have joined forces in a copper exploration venture in north-west Quebec. This venture is considered to be mutually beneficial to Quebec and France because it "répondre au plan de développement du Nord-Ouest québécois adopté par le Gouvernement québécois et aux objectifs d'approvisionnement en cuivre que s'est fixé le Gouvernement de la Republique francaise."
2. e.g. Compagnie Francaise des Petroles and the State owned ELF-FRAP.
3. National raw material stockpiling, which commenced in 1975, is administered by the state-run Groupement d'Importation et de Repartition des Metaux (GIRM).

United States

Resource management is a matter of paramountcy in the USA. Not only must it satisfy growing industrial requirements,[4] but resource demands arising out of its hegemonic role in international political and economic relations must also be met. Thus the USA must take steps to ensure secure and adequate supplies of both energy and minerals.

In the pursuit of this objective, the USA relies almost exclusively on the capacity of the private sector, and particularly on the ability of its transnational corporations (TNCs). Hence it seeks to enlist the cooperation of TNCs by offering them two types of economic incentives: tax concessions, and an overseas investment insurance scheme.

Tax concessions are by far the most powerful incentive offered by the U.S. government to natural resource companies operating overseas. Chief among these tax concessions is a special form of depletion allowance. This special allowance for depleting ore deposits is computed on the basis of gross income from overseas activities and, as a rule, results in an allowance of more than 100 percent. Depletion allowance of this kind is granted only to U.S. incorporated companies operating mining ventures abroad.

Quite apart from this generous depletion allowance, the U.S. government customarily offers liberal foreign tax credits to U.S. companies in general. Equally important is the provision for special deductions with reference to the activities of the Western Hemisphere Trade Corporations.[5]

The other major incentive offered TNCs is an elaborate selfsustaining overseas investment insurance scheme. This scheme, administered by the Overseas Private Investment Corporation (OPIC),[6] insures private U.S. investment against the risks

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4. The USA is dependent on external sources for approximately 15 percent of its natural resource needs. Given the fact that the USA is by far the largest consumer of natural resources, this 15 percent in absolute terms represents a substantial part of world production. Moreover, it is worth noting that the USA is greatly deficient in a number of strategic minerals including cobalt, nickel, chromite, tin, palladium and manganese. In the case of oil, 43 percent of that country's domestic oil consumption is imported.
5. These are U.S. corporations whose affiliates operate almost exclusively in North, Central and South America, including the West Indies. The deductions permitted the Western Hemisphere Trade Corporations to reduce their effective U.S. income tax rate from 48 percent to 34 percent.
6. OPIC began its operations in January, 1971. It is the successor of the U.S. International Development Agency (AID). AID's primary responsibility was to facilitate economic development in developing countries by underwriting private U.S. investment undertakings in these countries. OPIC follows this tradition.

of expropriation, currency inconvertibility, and loss occasioned by war, revolution and insurrection, in approximately ninety developing countries. OPIC also provides project financing and related services where private financing is either not available or not adequate.

More recently, the U.S. Congress is beginning to look on OPIC as an institution which should be made to play a dominant role in assuring U.S. natural resource needs.[7]

OPIC's mineral and energy program aims at: revising and extending its insurance services and terms; expanding its financial services to investors; and collaborating with other U.S. and international agencies, industry associations, and private corporations to meet U.S. current and future mineral and energy requirements.

Aside from the two major incentives of tax and insurance, the USA has found it expedient to build up large inventories of critical raw materials.[8] In short, the USA has taken positive steps to realize its resource management objectives.

Japan

The overriding resource management problem facing Japan is the frightening reality that it is the most resource-deficient of all industrialized economies. Nearly one-quarter of the world's exports of eighteen essential mineral and energy commodities are destined for the Japanese market.

The gravity of the Japanese concern over the supply of natural resources stems from three factors. First, domestic supplies of oil, coal, and natural gas are minimal. Secondly, Japan's endowment of such strategic raw materials as iron, copper, zinc ores, bauxite, nickel, tin, chromium, molybdenum, tungsten, and aluminum is small relative to that country's industrial requirements. Finally, the sustained high growth rate of the Japanese economy, an economy which is largely export oriented,

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7. OPIC attempts to further U.S. resource management objectives by seeking to: spread its insurance liabilities by reinsuring through such underwriters as Lloyds of London and The Berne Union Investment Insurance Committee (furthermore, OPIC has initiated discussions with the European Economic Community concerning 16 European mining companies seeking joint EEC-OPIC insurance coverage); promote U.S. private investment in strategic minerals such as cobalt, tin, platinum, palladium, manganese and nickel, which the U.S. must import; and improve its insurance services to the mining and oil industry.
8. Stockpiles can be used for stabilizing production and prices and for this reason give cause for concern in the private sector. While these stockpiles insure against supply disruptions in emergencies, they are sometimes regarded by producer associations and private firms as a formidable weapon which may be employed to distort market forces.

underscores the extreme vulnerability of Japan to disruptions in external supplies of natural resources.

The Japanese government has sought to overcome this vulnerability by embarking upon a resource management strategy comprising two basic elements. The first of these elements is a major thrust toward increasing the number of countries supplying strategic materials to Japan. The second element involves the development of close cooperation and collaboration between the Japanese government and Japanese resource companies to secure overseas sources of supply through equity participation with foreign private corporations and foreign government enterprises.

The principal instruments employed by the Japanese government in support of its overall resource procurement strategy are: financial assistance to private corporations, foreign aid to governments, a flexible insurance incentive scheme, and tax concessions.

Government financial assistance takes the form of loan financing for and direct equity investment in overseas natural resource ventures. These forms of financial assistance are restricted to Japanese firms engaged in supplying essential commodities to the Japanese economy. Financial assistance is administered mainly by six agencies. These are the Metal Mining Agency of Japan (MMAJ), the Overseas Economic Cooperation Fund (OECF), the Japan Mining Corporation (formerly Overseas Mineral Resource Development), the Export-Import Bank of Japan (Exim-Bank), the Japan Petroleum Development corporation, and the Bank of Japan.

By providing loan financing and technical expertise, the MMAJ encourages Japanese private investment in the exploration of copper, lead, zinc, bauxite, nickel, manganese and chromium in developed economies. The functions of the OECF are similar to those of the MMAJ, except that the OECF, whose activities focus exclusively on developing countries, provides much more favourable investment terms.

The Japan Mining Corporation's activities are confined exclusively to developing countries, where it is engaged in exploration and development singly or in joint ventures. This is a unique organization in which government holds a 50 percent equity.

The Exim-Bank provides investment loans to Japanese firms engaged in opening new markets and/or in procuring raw materials. Resource procurement is fast becoming the major preoccupation of the Exim-Bank. Between 1973 and 1974, the Exim-Bank doubled its loan commitment to $1.2 billion for overseas resource development.

In addition to the activities of these agencies, the Japanese government also gives high priority to the provision of financial aid directly to those developing countries producing mineral, energy, and agricultural commodities imported by Japan.

To ensure future petroleum supplies, Japan has committed itself to expenditures of over $2 billion in a combined investment and aid program to the Middle East. The Japanese also employ an insurance investment scheme to encourage Japanese corporations to expand their overseas operations.[9]

Aside from these incentives, the Japanese government offers special tax concessions to encourage Japanese companies to expand their mining and petroleum undertakings overseas. Those companies that obtain long-term contracts for raw material imports benefit from highly favourable tax concessions.

All these initiatives exemplify a close partnership and a high degree of cooperation between government and industry in an effort to realize the national resource objective.

The Federal Republic of Germany

The prosperity of the Federal Republic of Germany (FRG) is intimately linked with her ever-growing export industries. In recent times, these industries have grown to account for fully 30 percent of GNP. In order to sustain the country's industrial activity and provide for economic expansion, however, the economy relies heavily on imports of natural resources. It is notable that, apart from domestic sources of supply of coal and lignite, the FRG has meagre endowments of nearly all fuel and nonfuel minerals as well as energy resources. Not surprisingly, therefore, West Germany has found it expedient to implement a resource management strategy aimed at ensuring the supply of her raw material industrial inputs.

The FRG relies primarily on three measures to provide its raw material supplies. The first of these takes the form of government grants and loans for exploration for and development of raw materials. Exploration grants are subject to repayment only if the venture is commercially successful. Loans are subject to two overriding conditions: the borrower is required to negotiate a long-term purchasing contract with the host country, and the repayment period should not exceed the duration of the purchasing contract.

The second measure is an overseas investment insurance scheme offering protection against political uncertainty and economic risks for undertakings in developing countries. The scheme provides insurance coverage for 95 percent of the direct capital investment. Thus the investor risks only 5 percent of his total investment outlay.

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9. This scheme is administered by the Ministry of International Trade and Industry (MITI) in conjunction with the Exim-Bank and MMAJ. It provides overseas Japanese natural resource operations with flexible coverage and highly favourable terms for underwriting political and commercial risks.

Tax incentives represent the third measure employed to ensure security of supply. Where German subsidiaries are located in developing countries and double taxation agreements do not provide for the tax exemptions for distributed profits, matching credits are made available up to the amount of German taxes payable. This provision of the FRG's Developing Country Tax Law has a remarkable promotional effect in that it enhances the relative attractiveness of the host country's investment climate.

Common Features

Certain common features are evident in the resource management strategies of France, the USA, Japan, and the Federal Republic of Germany. These are:

i) a heavy reliance on foreign sources of supply of essential raw materials, and the necessity to take action to ensure long term security of supply;
ii) the provision of special incentives, to encourage private investors in the resource sector to exploit the abundant resources of selected developing countries;
iii) a high degree of government-industry cooperation in resource procurement;
iv) a recognition of the importance of TNCs in meeting their resource procurement objectives, while being powerful agents for economic development in the south. Thus TNCs are seen as a formidable economic link between the north and the south.

The resource management initiatives of the south will further attest to the importance that the south attaches to the role of TNCs. It will be shown below how the inducements offered TNCs by developing countries to exploit their resource base complement the resource management strategies of the north.

RESOURCE-ABUNDANT DEVELOPING COUNTRIES (THE SOUTH)

All resource-abundant developing countries perceive their natural resource endowments as a prime source of economic growth and industrial diversification. However, the realization of their economic growth potential from natural resource exploitation is fraught with numerous difficulties. Many of these difficulties originate in traditional patterns of political and economic relations between industrialized economies and developing countries.

> Many of the disquieting conditions of existing trading patterns originated in the era of colonialism, when low-cost supplies of raw materials were secured by metropolitan industrialists exploiting the rich resource-endowment of the colonies. For the most part, these *entrepreneurs* were not concerned with the balanced development of the colonial economies. Consequently, while raw material exports became the mainstay of colonial economic life, they did not construct the base for industrial diversification. This partly explains the lopsided structure of many developing economies today, as well as their vulnerability to the cyclical and secular changes of business activity in the industrially advanced world.10

10. Chambers and Reid (1977).

Herein lies the overriding concern underlying the demands of developing countries for access to markets, transfer of technology, further processing, monetary reform, access to the capital markets of developed countries, and a code of conduct for transnational corporations.

Industrialized economies are striving to accommodate some of these demands of the developing countries in a manner which appears at the same time to reinforce the resource management strategies of the north. In this context, TNCs are regarded as the most appropriate vehicle for servicing the industrial needs of both north and south.

The activities of TNCs in international commodity and capital markets are recognized as major links in the complex network of economic relationships between industrialized economies and developing countries. No only, for example, are TNCs the main purveyors of technology, but they are also particularly well equipped to provide requisite packages of technology, capital, managerial skill and market access to developing countries. Consequently, many developing countries lacking capital, technology, managerial expertise and markets, but having an economically desirable natural resource base, try to attract TNCs so as to realize their resource management objectives.

Since TNCs are attracted not only by the resource base of a country but also by the investment incentives offered by governments, many developing countries strive to provide a range of inducements to attract foreign direct investment. These inducements or incentives take diverse forms but are designed primarily to minimize corporate risk and uncertainty by facilitating the early recovery of capital costs.

A survey of the resource management policies of resource-abundant developing countries reveals that these countries employ both legal and economic instruments to improve the relative attractiveness of their respective investment climate.

Generally speaking, legal instruments consist of a code plus contractual arrangements. The code consists of a set of legal rights and obligations which provide the framework within which resource development is administered. Legal rights from the point of view of the investor include safeguards against certain kinds of governmental interference in legitimate corporate activities. Obligations, on the other hand, relate to the requirements which the state demands that business enterprises should meet as a necessary condition of their operation.

Since a code can be used to reduce corporate uncertainty by specifying clearly the rights and obligations of investors, and also to provide special incentives to attract investment capital, it is not surprising that developing countries have sought to consolidate their laws and regulations respecting foreign direct investments in this form.[11] The code then becomes an important instrument for resource

11. See United Nations (1978).

management, but usually does not preclude the host country from entering special contractual[12] arrangements with TNCs in addition. Indeed, growing state involvement in all stages of natural resource development is giving contractual arrangements added importance as a tool of resource management. Contractual arrangements afford countries added flexibility to cope with dramatic external changes which reduce the relative attractiveness of their economies for foreign direct investment.

The effectiveness of contractual arrangements can for example be seen in the range and potency of the incentives offered in a foreign investment contract concluded between the Chilean government and Noranda Mines Limited of Canada. Some of the more attractive incentives offered include:

i) total freedom from payment of any customs charges or duties of any kind; exemption from value added tax, consular fees, imports deposits, or other obligations or requirements affecting the importation of machinery, equipment, accessories necessary to form part of the investment;
ii) the election, once only, between normal or accelerated depreciation. As well, all preparation and development costs incurred before the beginning of commercial exploitation can be written off within five years of the latter with all subsequent similar costs being written off immediately.
iii) the right to remit freely abroad all or part of profits or dividends of joint venture;
iv) free access to the money market to sell funds brought to Chile as part of investment and also to buy funds necessary for remittance abroad;
v) a guarantee to retain abroad part of export receipts necessary for operating costs, technical assistance, etc.;
vi) the establishment of taxation levels for 30 years from the date of initiation of commercial operation.

It is evident from the foregoing that legal instruments — codes and contractual arrangements — constitute effective devices for altering the relative attractiveness of investment climates.

Economic instruments can be employed equally well to improve a country's investment climate. A country can, for example, employ fiscal, monetary, commerical and

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12. It should be pointed out that contractual arrangements are not immutable. Initially host countries, eager to attract foreign capital, will provide the best possible conditions. Thus in the first instance TNCs have the bargaining edge. Later, however, when the project becomes fully operational and the TNC is earning high profits, the host country usually tries to recoup some of its earlier costs, and may in consequence seek to extract greater socio-economic benefits from the activities of the TNC. Hence contractual arrangements are not *faits accomplis*, but represent initial bargaining positions which are subject to renegotiation from time to time. For an informative discussion on contract bargaining see Waelde (1977).

industrial policies to influence the TNC's choice as to where it will invest. Such policies may take the form of:

i) foreign exchange rate measures which permit the unfettered repatriation of dividends and capital, and the importation of requisite capital equipment, services and other factor inputs;
ii) tariff and nontariff measures to protect domestic producers, while serving as an incentive for TNCs;
iii) a tax regime which explicitly recognizes and provides for economic and geologic risks associated with natural resource exploitation in a developing economy;
iv) sovereign risks guarantees, where government acts as guarantor of project development loans.

The Brazilian experience amply illustrates how a developing economy seeks to enhance the relative attractiveness of its investment climate. Brazil gives high priority to the development of its resource sector as an aspect of its overall industrial strategy. To attract the requisite capital from abroad the Brazilian government offers TNCs the following investment incentives:

i) a 20 percent mine depletion allowance for income tax purposes;
ii) the waiving of import duty on equipment for the mining industry;
iii) a special reduction of tax on export minerals;
iv) the waiving of tax on minerals for agricultural purposes;
v) special financing programs for exploration for minerals with insufficient reserves;[13]
vi) minimal environmental controls and standards.

These investment incentives, in combination with relatively low labour costs and a union-free environment, have accounted in large part for Brazil's success in attracting over 50 foreign-owned mining companies to that country.[14]

Despite its apparent success, the Brazilian experience does not afford a sufficient basis for generalization on the use of legal and economic instruments. Each developing country does in fact constitute a special case when viewed in respect to such factors as the industrial strategy and industrial structure of the economy, the nature of the country's factor endowments, and the social and political attitudes and willingness to accept measures designed to enhance foreign direct investment.

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13. In the mining sector the Federal Company for Mineral Reserves Exploration (CPRM) will under certain circumstances advance up to 80 percent of the money required for an approved exploration program. Under one program the money is lent at 5 percent interest, while another program offers a risk-sharing forgivable loan. In 1973 the CPRM approved a total of 13 loans amounting to $6 million.
14. Included in these 50 firms are such Canadian TNCs as Noranda, Inco, Falconbridge, Cominco and Alcan.

In the final analysis the effectiveness of legal and economic instruments will depend largely on a country's ability to establish and maintain a stable and attractive political environment, while offering a competitive investment climate.

Having examined national measures employed by the north and the south to attain their respective resource-management objectives, we will now consider how these polar groups utilize regional and international arrangements to reinforce their domestic policies.

REGIONAL AND INTERNATIONAL ARRANGEMENTS

It is a universally accepted principle that the regional and international initiatives of a country are largely an extension of domestic policy objectives. The initiatives, both regional and international, of the north and the south substantiate this proposition. The EEC, for example, in its effort to ensure security of supply of raw materials, has attempted to reinforce the national initiatives of member states through the introduction of a scheme linking certain Asian, Caribbean and Pacific (ACP) countries with European consumer countries. This regional scheme, known as the Lomé Convention, was launched on February 28, 1975.[15]

For the EEC, Lomé represents an effective resource-procurement strategy. This strategy heralds a novel trading arrangement which re-establishes colonial trading links. ACP countries view the scheme as a valuable mechanism for ens ring income stabilization. Moreover, it provides the basis for cooperative industrial, financial and technological activities which are essential for economic growth and development in the third world.

At present, the income stabilization provision (STABEX) of the Lomé Convention relates, save for iron ore and concentrates, primarily to tropical agricultural commodities. It should be noted however, that the EEC is now contemplating the development of a global STABEX. The proposed scheme would be made to include all agricultural products and a wide range of mineral commodities including copper, bauxite, alumina and aluminum, tin, iron and phosphate. This could conceivably have a pronounced impact on the composition and direction of world trade in minerals and the other commodities covered by STABEX.

15. The scheme provides for the following: free access without reciprocity to the European makret for goods exported from the ACP; a stabilization fund (STABEX) to compensate the ACP in the event of reductions in the receipts they derive from the export of their principle basic products; financial aid for the ACP, including Units of Accounts (U.A.) 3,000 million from the European Development Fund, and U.A. 390 million from the European Investment Bank; industrial and technological cooperation, aimed to promote a better international division of labour on lines advantageous to the ACP; and joint institutions to supervise observance of the agreement and promote discussion between the groups of countries.

Another far-reaching initiative which is being mooted by the EEC is the establishment of a facility for complementing and reinforcing the resource management policies of member countries. This proposed EEC facility is designed to:

i) harmonize and reinforce existing national overseas investment insurance schemes;
ii) provide financial assistance for project development, including infrastructure. Repayment may be in kind (i.e. in the form of raw materials).

All these initiatives of the EEC strongly support the resource-management objectives of member countries. At the same time, they meet some of the demands of the developing countries as expressed in the north-south dialogue.

Regional resource-management initiatives are not confined solely to the north. Some developing countries have launched complementary resource development programs, notably regional insurance guarantee schemes such as the Fonds d'entraide et de garantie des emprunts du Conseil de l'Entente and the Inter-Arab Investment Guarantee Corporation (IAIG).[16]

International institutions are also especially important avenues through which national governments constantly seek to further their domestic objectives. The issues of the north-south dialogue, especially those pertaining to finance, trade, and development, find their fullest expression in and are supported through some of these international institutions.

Developing countries see access to markets and equitable terms of trade for their commodity exports as vital for their economic growth and industrialization. The north has responded by supporting measures aimed at the provision of financial assistance to offset balance-of-payments deficits, the arrangement of debt re-scheduling, efforts toward the establishment of an integrated program for commodity trade, and the granting of special preferential tariff concessions (GSP). Many of these measures are mediated through such international institutions as The World Bank, the GATT, specialized agencies of the U.N., and the International Monetary Fund. This is exemplified by the activities of the United Nations in fostering natural resource exploitation in developing countries. United Nations agencies

16. The Conseil de l'Entente was the first of such schemes to be founded regionally among developing countreis. Commencing operations on June 9, 1966 with resources subscribed by its member countries (Dahomey, Ivory Coast, Niger, Toga, Upper Volta, and later joined by four other countries in the region) of $5.3 million, the Conseil seeks to reduce the commercial risk of regional lenders through a system of loan guarantees. The IAIG, founded in 1974 with a capitalization of 10 million Kuwait dinars, protects both the lender and the investor in Arab member countries against losses due to expropriation, currency restrictions and regulations, and insurrection.

provide support for the development of infrastructural facilities,[17] the undertaking of feasibility studies, and the supply of technical assistance in the early stages of project development. In addition, the U.N. and other international institutions offer developing countries long-term loans at low interest rates with a grace period of up to five years.

Although these institutions account for a relatively small part of the total capital needed for resource development in developing countries, the impact of the involvement of these international institutions in project development is far more substantial than is usually imagined.[18] In the first place, their participation is in high risk areas and usually operates to eliminate many of the cost and risk factors that would normally be encountered by private investors. Secondly, the activities of these institutions give projects a stamp of respectability which enables developing countries to secure loans from commercial banks at reasonable rates.[19]

In summary, the financial, trade and other concessions offered to developing economies through these international institutions tend to improve the investment climate of the recipients, while furthering the resource-management objectives of both the north and the south.

SUMMARY

We have demonstrated that a range of national, regional and international measures employed by major industrial economies to attain their resource-management objectives complements some of the resource-management priorities of certain third world countries. Similarly, it has been shown that many of the measures which third world countries put into play, to further their economic growth and development through the use of indigenous natural resources, do accord with the resource-procurement initiatives of the north.

Admittedly, the differences in the resource bases, industrial requirements, and other factor endowments of countries comprising each polar group will affect the nature and the extent of benefits derived by each country from north-south trading

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17. Infrastructural support provided by these agencies sometimes amounts to one-third of the total costs of the project.
18. The role of export finance and supplier credits should also be noted here. These credits, available from some OECD member countries, are becoming a major part of project financing in developing countries. A recent UN report (United Nations Panel on International Mining Finance, No. 4, 1977) notes that "it has, in fact, become typical for the export finance component of a financing package to be the first to be negotiated, because of advantageous financial terms typically associated with such financing."
19. United Nations Panel on International Mining Finance, No. 5 (1977).

arrangements. While the distribution of benefits arising out of these trading arrangements varies from country to country, the evidence points to growth in the number and scope of strategies which reinforce and complement the industrial development objectives of the two polar groups, thereby proclaiming the desirability of establishing stronger north-south trade ties. These trade ties are observable in the activities of the TNCs which link the two polar groups through the markets for raw materials, investment capital, and technology. Indeed, TNCs, by providing third world economies with essential ingredients for their economic development while meeting the raw material requirements of the north, have enmeshed the polar groups in a network of economic and political relations. Viewed in this perspective, it seems logical that both the north and the south do offer special incentives to TNCs.

The complementarity of the initiatives of the polar groups is strikingly apparent in a variety of regional and international institutional arrangements. In these arrangements both groups support financial, trade, and other measures which act as powerful incentives for TNCs to locate in developing countries with abundant resources.

IMPLICATIONS

The emerging resource-management strategies of the north and the south are likely to generate important resource-management problems for penumbra countries. Some of the more important of these problems relate to the following factors.

i) *The investment climate:* emerging trade, financial and tax concessions (e.g. GSP, sovereign risks guarantees, soft loans, and tax holidays) serve to reduce the political and economic costs of natural resource exploitation in third world countries, thereby making the penumbra countries relatively less attractive to potential investors.

ii) *International competitiveness:* investment concessions, relatively low labour costs, and in some cases, union-free environments reduce production costs considerably in third world countries. Hence even where productivity is high in penumbra countries, the reduction in cost associated with this high productivity may not be sufficient to offset the magnitude of the subsidy afforded by available trade, financial and other concessions. That is to say, the combined concessions offered TNCs to locate in the south could adversely alter the comparative cost advantage of penumbra countries, and thereby render them less competitive in world markets.

iii) *Market access and market share:* the measures now being undertaken by the polar groups are creating new trading patterns. TNCs, few in number but accounting for much the greater part of world trade in commodities, are being induced to increase the volume of trade between north and south in a manner that is supportive of each country's resource-management objectives. Trade

flows are also being influenced by the growth of state trading which is tied by contractual agreements (e.g. Lomé). These changing conditions would seem to limit the access of penumbra countries to both traditional and emerging markets.

iv) *Economic growth and industrial diversification:* the likely diversion of trade and investment flows away from penumbra countries could necessitate structural changes in the structures of their economies, which have customarily relied heavily on the export of primary commodities. In addition, the emerging pattern of interdependence between the north and the south could severely constrain the efforts of penumbra countries to achieve greater industrial diversification through further processing of raw materials.

The potential impact of north-south trade relations on the welfare of penumbra countries should constrain penumbra countries to develop and coordinate resource-management strategies based on national interests and mutual benefit. The strategies which we outline below suggest ways which Canada could respond to the changing conditions of international world trade and development.

Resource managers should take into account two sets of interrelated problems. The first set of problems are those which perennially beset resource-producing countries. They encompass such things as erratic movements of commodity prices, instability of foreign exchange earnings, and an adverse secular trend in the terms of trade of primary commodity producers. These problems have been central to international discussions on trade and development. In addition, resource-producing countries are now experiencing:

i) a marked decline in the rate of growth of industrially advanced economies and a concomitant fall in demand for natural resources, born in part out of energy conservation measures leading to a reduction in demand for crude raw materials;
ii) increased competition among a growing number of resource-producing countries — many of which are obliged to sell commodities at a loss in order to secure needed foreign exchange to service debt and pay for vital merchandise imports.

The second set of problems which policy makers face are peculiar to penumbra countries because of their place in the north-south dialogue, and include:

i) a reduced dependence of the major resource consumer countries on traditional sources of supply;
ii) decline in the rate of investment in exploration and development.

Although all penumbra countries would seem to share common resource-management problems, resolution of their problems demands differing strategies, because of differences in economic structure, political systems, and social objectives.

CANADIAN RESOURCE MANAGEMENT

In Canada, the ability to come to grips with many of the problems now facing the natural resource industry is severely constrained by the reality of Canadian federalism. It is well known that under the B.N.A. Act (Section 109) the ownership of natural resources is vested in the provinces. Consequently, each province has enacted natural resource laws and has exercised authority in the field of direct taxation, manpower supply policy, and environmental protection, in order to manage natural resources primarily to meet provincial social and economic priorities. But while ownership of the resources is vested in the provinces, management of the resources also falls within federal government jurisdiction. Through its extensive control of trade, transportation, manpower, and fiscal and monetary policies, the federal government endeavours to influence the pattern of resource development in the national interest. Because the two senior levels of government see resources from differing view points — the provinces in terms of provincial priorities and the federal government in terms of the national economy and regional equity — both levels of government have instituted policies to further their respective resource-management objectives. This is not without cost.

Interdependence, duality of interest, and the resulting policy decisions of the ten provinces and the federal government tend among other things, to:

i) create uncertainty among would-be investors and trading partners respecting which level of government is responsible for Canada's resource development;
ii) inspire competition among provinces for private investment, which reduces effectiveness in bargaining for the most advantageous terms from TNCs wishing to invest in Canada;
iii) weaken and complicate the country's negotiating powers with other governments in such areas as tariff negotiations, contractual arrangements, and commodity agreements because of the difficulties of presenting a consistent and unified national posture;
iv) lead to federal-provincial differences over issues respecting resource development and trade, tax sharing arrangements, and industry control.

Both the international environment and the complexities of Canadian federalism will continue to pose problems for Canadian resource management for some time to come. Admittedly federal-provincial cooperation in resource management would go a long way in strengthening the country's ability to deal more effectively with present problems. Nevertheless, Canadian resource managers would do well to begin considering a range of measures which could be employed to strengthen the economic viability of the Canadian natural resource industry and its contribution to the general economic well-being of Canada. Resolving the issues discussed here is, to say the least, a difficult, but not impossible, task, demanding much time and co-operative activity.

At this point, therefore, we would like to advance some suggestions for the consideration of resource managers in both the public and private sectors.

i) Emphasize in the U.N. and other international forums the unique position Canada should occupy in the north-south dialogue. Failure to have Canada's special resource-management problems recognized internationally could limit the growth and development of the resource sector, thereby adversely affecting employment, foreign exchange earnings and industrial diversification based on natural resources.

ii) Reassess the appropriateness and adequacy of the principal measures now being employed by Canadian resource managers to meet current problems. In so doing resource managers may wish to examine the following.

a) *Commercial policy:* to what extent does the Canadian position at the GATT, at CIEC, OECD High Level Group on Commodities, the Common Fund, etc. recognize how Canadian resource development will be affected by changing trading patterns sponsored by the policies of the polar group of countries?

b) *Fiscal policy:* given the fact that resource taxes are a major determinant of investment in the resource sector, and given the existence of two tax regimes in Canada, care should be exercised in designing a stable national resource tax base. In the development of such a tax base, resource managers may wish to pay particular attention to two things. The first is that it may be unwise to rely entirely on international tax comparisons in the determination of an appropriate tax base. This is so because, although a country's tax rate may appear relatively attractive, it may be less so when taken in conjunction with the non-tax incentives offered by competitor countries. The second consideration is that of the desirability of taxing corporate earnings in such a way as to reduce some of the uncertainties associated with long-term investment planning. This may in fact be a powerful investment incentive.

c) *Research and development:* since the quality and quantity of ore bodies are important determinants of the relative attractiveness of a country for mineral resource development, research and development aimed at improving the recovery rate of minerals will enhance the country's competitiveness for investment in minerals. In addition, research and development provide a technological base which represents a valuable asset. Many third world countries are willing to exchange equity participation in mineral development for technical expertise which is an integral part of any research and development program.

d) *Infrastructural facilities:* Canada can boast excellent infrastructural facilities, such as a well established banking system, advanced communication and transportation networks, a cadre of professional and skilled manpower, and adequate supplies of energy. These facilities, which really constitute external economies to potential investors, should be seen as bargaining levers.

e) *Investment incentives:* the north recognizes that taxes, financial concessions, and investment insurance schemes can be effectively employed to induce TNCs to move into resource development in third world countries. It is extremely important for Canadian resource managers to be aware of these incentive schemes. Not only are these schemes likely to divert investment away from Canada, but they may also limit Canada's attempts to expand her third world markets. Consequently, it is expedient to re-evaluate the adequacy of existing Canadian programs in this area.

iii) Develop a system for monitoring changes in the relative attractiveness of investment in natural resources. Such a system should assist in identifying the principal forces which are operating to reduce the relative attractiveness of Canada's investment climate. At the same time the monitoring process could also serve to pinpoint investment and other economic opportunities abroad for the Canadian resource industry.

iv) Develop an integrated sectoral approach to resource management — integrated in the sense that each domestic regulation affecting resource development is assessed not only in terms of its impact *per se*, but also as a integral part of a range of other existing institutional measures governing the resource sector. An integrated management approach would assist both levels of government to see the cumulative impact of various governmental policies (e.g. environmental standards, regulatory controls, taxation and manpower) on the economic viability of the resource sector. Moreover, it could lead to a reduction in many of the growing administrative costs of managing the resource sector generally, while facilitating effective industry-government communication. Apropos of this, it may be necessary to take steps to create a greater awareness among Canadian business management generally of the changing international environment and its far-reaching impact on Canadian companies.

In considering these suggestions it should not be thought that government and industry have been altogether remiss in facing certain resource management problems. Indeed, we should hasten to point out that there are quite a number of programs now afoot which are responding to some of the concerns voiced here, many arising out of initiatives taken by the federal government. Here we can note the activities of such agencies as the Export Development Corporation, Enterprise 77, the Canada Development Corporation and the Canadian Commercial Corporation, to mention but a few of the federally sponsored initiatives. Other initiatives have come from the provinces, the most notable of which are the efforts of SOQUEM (the Quebec owned mining agency) which is modelled after France's BRGM. Industry too is taking positive steps in meeting a changing domestic and international environment. One of the more striking of these is the efforts of Inco to sell, through a newly formed division, Inco Tech, its consulting services and process technology in the mineral exploration and development field to customers in Canada and abroad.

Finally, the success of Canadian resource managers in dealing with the challenges of the north-south dialogue will hinge largely on the ability of industry and government to cooperate effectively in developing mutually beneficial working arrangements.

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IMPLICATIONS OF CURRENT TRENDS IN CANADIAN MINERAL TRADE

A Digest of the Discussion

The seminar papers covered a wide range of topics, designed to generate discussion around the theme: 'Canada's Mineral Trade: Implications for the Balance of Payments and Economic Development.' It was generally agreed that Canada's mineral trade is presently in a state of relative decline, in terms of both Canadian GNP and Canada's share of world mineral markets. Analysis of realistic estimates of potential changes in the level of mineral trade showed that such changes would have a fairly small impact on the balance of payments. However, the implications of the decline were felt to be more serious for the overall development of the Canadian economy. Discussion tended to concentrate on areas related to the promotion of mineral trade. Merits and methods of promoting further processing of minerals in Canada were also considered. Widely varying viewpoints were in evidence, leading to predictable differences of opinion between representatives from industry and government, provincial and federal governments, and even different departments of the federal government.

DECLINE IN MINERAL TRADE

A number of factors, both domestic and external, were identified as contributing to the decline in Canada's mineral trade. Increases in federal and provincial taxes were identified as a principal factor in the slowdown of growth in the domestic mineral industry. The resulting reductions in the rate of return have discouraged investment and given rise to problems of cash flow. This in turn has led to a serious reduction in the level of exploration. The second major domestic

factor currently troubling the mineral industry was identified as the uncertainty created by conflicts and changes in government policies. Conflicts over jurisdiction have arisen between government departments, and between federal and provincial governments, in areas including land use, environmental controls, and taxation. Frequent changes, and confusion over interpretation, have occurred with respect to the same areas as well as others such as competition policy, foreign ownership policy, and health and safety. The resulting uncertainty on the part of the industry, as to courses of action that are open to them, have contributed to a decline in investment.

The current trend towards increased third-world production of minerals was identified as a major external factor contributing to the decline of Canada's share in world mineral markets. These countries currently enjoy many of the natural advantages in mineral production, such as easily accessible high grade ore and low labour costs, that once gave Canada its leading role in mineral exports. In addition, some third-world countries are selling their production at prices that cover operating costs but without provision for return on investment, because their objectives are broader than those of private industry. The possibility exists that current trends in foreign aid and in international institutional lending will continue the expansion of mineral development in third-world countries even if such developments continue to be uneconomic, thus prolonging the period of depressed prices for certain minerals for some time. There was also some concern that trading blocs which exclude Canada may reduce the market access of the Canadian mineral industry.

In addition to domestic financial problems and increased international competition, the mineral industry is faced with a decline in the rate of growth of demand for minerals. This decline is the result of general economic downturn, but has also been influenced by certain noncyclical factors related to the current philosophy favouring conservation of resources, and to changes in relative prices of commodities. This trend has been exacerbated by the OPEC increases in the price of oil, which have led, for example, to reductions in the size and weight of automobiles. Weight restrictions have led to a significant degree of substitution of plastics and aluminum for steel and zinc in automobile manufacture.

On the positive side, some participants felt that there is still reason for optimism in the mineral industry and its prospects for international trade. The Canadian mineral industry operates in a relatively stable political environment, with good infrastructure and energy facilities, and continues to have market access to the United States as well as other major purchasers. The industry also has a background of management and technological experience which enables it to exploit the available resources.

Industry representatives concluded that, given a favourable domestic climate, the Canadian mineral industry can cope with current and future problems in the international situation and maintain a strong position in mineral trade.

BALANCE OF PAYMENTS

Effect of Mineral Trade

Observation of the overall position of the mineral sector in Canada's international trade clearly shows that mineral trade is an important determinant of the balance of payments. However, the MacKinnon paper pointed out that increases in mineral production capacity that can realistically be anticipated will lead to very small changes in the balance of payments. The paper was seen as very specific, but offering a useful approach for analysis because it covered a realistic range of possible impacts. While MacKinnon was concerned with absolute changes in the balance of payments, other participants argued that marginal changes are more significant than absolute changes, in terms of impact on economic development.

Several problems were noted in studying the effects of changes in levels of mineral trade on the balance of payments. The balance of payments is a dynamic concept, and individual impact studies have tended to be static, resulting in extremely theoretical conclusions. Attempts to relate exchange rate changes directly to the effects of certain exports, such as minerals, are hampered by the intervening effects of other factors such as speculation, the capital market, and political factors. Furthermore, studies relating exports and exchange rates through the concept of elasticity may also be unreliable, since elasticity figures taken from the literature may be inadequate or inappropriate for specific studies.

It was pointed out that over the long term, the balance of payments, in theory at least, must move towards equilibrium due to adjustments in exchange rates. Nevertheless, in the short term, balance-of-payments deficits definitely do exist, and must be addressed. Participants felt strongly that an overall balance of payments should not be considered as a policy goal in itself, but rather as a constraint on economic policy in general as well as on policies related to development of mineral trade.

Implications

Discussion of the implications of changes in the level of mineral trade for the balance of payments centred on two issues: the exchange rate, and the sources of capital. Of the two, the latter was considered as offering greater scope for positive action.

The exchange rate both influences and is influenced by the volume of mineral exports. However, these mutual influences are somewhat limited. While depreciation of the exchange rate can lead to short-term increases in the demand for Canadian minerals, it cannot be considered a permanent solution to declining markets. The competitive advantage will be lost over the long term as other adjustments come into play. At the same time, it was felt that increases in the volume of mineral exports would

have very little effect on the exchange rate. One participant expressed the view that changes in mineral prices were more significant than changes in the exchange rate in terms of effect on the volume of mineral exports.

Interest was expressed in Wilkinson's scenarios for various means of obtaining capital, and the resulting effect on the balance of payments. It was noted that the scenario involving the raising of funds by printing money ignored the effects of inflation.

The large amounts of capital required for mineral development have had a significant effect on the balance of payments, since a major proportion of the capital has been raised through foreign borrowing. Wilkinson's view that borrowing abroad was generally beneficial to the balance of payments and to Canadian economic development was accepted, provided that funds acquired from abroad were used for capital projects, and not for repayment of current debts. However, concern was expressed over the actual volume of borrowing, on the grounds that accumulation of extremely large foreign debts will in the long term prove detrimental.

It was noted that capital flows are controlled by institutional factors, and that changes in their rate or direction will require changes in the outlook of major international financial and industrial institutions. Concern was expressed over the fact that foreign investors may be discouraged from investing in Canada if they perceive Canada to be a poor investment risk. Since from the investor's point of view the perception of risk is at least as important as the reality, it is essential to maintain or restore Canada's reputation as a good investment area in order to ensure continuing supplies of foreign capital.

Although Canada's merchandise mineral trade has consistently yielded a surplus, there is an increasing deficit on certain mineral-related items such as foreign patents, managerial services and technology. It was suggested that an increased emphasis on mineral research in Canada, combined with active marketing of Canadian expertise in mining and mineral processing, might provide opportunities to offset this deficit.

ECONOMIC DEVELOPMENT STRATEGIES

Effect of Mineral Trade

It was generally agreed that a strong mineral industry has made a major contribution to Canada's economic development and continues to play a major role. An industrial strategy that supports growth of the industry is therefore seen as important to the overall wellbeing of the Canadian economy. A number of policy areas were identified within which government and industry could act to improve opportunities for growth in the mineral industry.

There was, however, less support for an industrial strategy that singles out and encourages the relative growth of the processing sector of mineral industry. It was noted that Canada has an excellent record in productivity for metal mining and primary processing. However, the further up the manufacturing chain, the lower Canada seems to rate in productivity. Consequently, in terms of value added, the mining sector has more to offer than has further processing. Smelting and refining is generally capital intensive and does not require large inputs of labour, so it contributes little to the solution of the problem of unemployment. Nor does it tend to lead to industrial agglomeration in the surrounding area. Contrary to the findings of the McCulla paper, it was felt that linkage analysis suggests that further processing does not offer particularly significant opportunities for related economic growth.

However, it is impossible to generalize over the entire range of minerals. Further processing opportunities for each mineral must be considered separately. For minerals such as zinc, which has several distinctly different applications, consideration must be even more detailed. Some opportunities were seen for an eventual increase in processing of copper in British Columbia and zinc in New Brunswick. Overall, however, little change was anticipated in proportions of crude minerals and processed minerals (about 50/50) exported from Canada.

The Wilkinson paper generated discussion concerning the determinants of location for further processing facilities. Transportation costs were felt to be of greater significance in determining location than Wilkinson had suggested. Discriminatory pricing practices were cited, and reference was made to a study of the steel industry which showed that the cost per ton for European shipments to North American was between $10 and $15, compared to $20 to $30 per ton for shipments from North America to Europe. Transportation costs for the by-products of further processing may also be significant in determining location. For example, copper smelters may in the future be located in agricultural areas, to reduce the cost of shipping such by-products as sulphuric acid for fertilizer production.

Some participants felt that Wilkinson had underestimated the barriers imposed by political borders, and the importance of geographical proximity to markets, particularly with respect to those products of further processing that are used as inputs to other industries.

Implications for Government Policies

i) *Taxation.* There was general agreement that taxation should permit an adequate and fair rate of return on investment. The tax system should take into account the cyclical nature of the mineral industry and its heavy dependence on foreign markets.

ii) *Stability and consistency in governmental policies.* While it was recognized that the mineral industry copes satisfactorily with market uncertainties,

it was felt that the uncertainties resulting from government actions have increased sharply in both kind and degree, particularly over the last ten years. Federal and provincial governments should endeavour to stabilize policies and minimize conflicts in areas such as taxation, competition, land use, environmental controls, foreign ownership and health and safety.

iii) *Sources of capital.* A number of areas and agencies exist through which governments can actively and directly provide capital for the expansion of the mineral industry and of mineral trade, including the Export Development Corporation, the Canada Development Corporation (CDC) and the Canadian Commercial Corporation. In general, loans were favoured over equity for government financing, although it was recognized that there may be special circumstances requiring large amounts of financial support which may make the equity approach attractive. It was pointed out that Canadian government equity does not necessarily insure that Canadian content will be a dominant consideration in mineral company operations. For example, Texasgulf, which is one-third-owned by CDC, has recently purchased a Japanese smelter for its Canadian facilities.

Indirect subsidization of the mineral industry through provision of infrastructure facilities such as transportation and energy has been a good government investment in the past, and continues to be necessary for the support of the mineral industry. It was pointed out that certain welfare measures such as unemployment insurance are also indirect subsidies to the industry, particularly over the low portion of the cycle.

The most essential contribution of government was identified as the establishment of a favourable business climate that will encourage investment from the private sectors, both domestic and foreign.

iv) *Further processing.* In general it was felt that further processing of minerals did not always provide the benefits of increased employment and income popularly attributed to it. Further processing opportunities should be assessed on an individual basis, rather than supported as a matter of principle. Some participants favoured government subsidization of further processing facilities in cases where social cost-benefit considerations make otherwise uneconomic projects attractive.

v) *Research and development.* An intensive effort in customer- and problem-oriented applied research is essential in order to retain markets currently threatened by new suppliers or substitution. Research should be conducted within industry. Industry spokesmen felt that government grants for industrial research should be available for research facilities of Canadian companies outside Canada, since it is often essential that suppliers be in extremely close contact with customers. For example, it was noted that some Canadian companies were losing sales in the United States and Europe because the research facilities in Canada were too far from the customers. It was

also pointed out that research tends to benefit larger firms more than small ones, in part because the larger firms are more likely to have market access, a vital adjunct, if research is to lead to sales.

It was felt that research and development in the mineral industry merited a closer look and should be considered as a topic for a future CRS policy discussion seminar.

vi) *Tariffs.* There was no general agreement on the question of tariff protection versus free trade, although some argued that increases in the level of processing in Canada would necessitate an increase in the need for tariff protection. It was suggested that bilateral and specific production-sharing agreements such as the Canada-United States auto pack would be preferable to a free trade policy. However, it was pointed out that the automobile production agreement with the United States resulted in the shifting to the USA of research and development in that field. It was suggested that the GATT negotiations would not lead to any significant changes, in view of current trade patterns, and that therefore exchange rate changes are likely to be more significant than foreseeable tariff changes for Canadian trade.

Certain participants emphasized that it is essential that Canada's interests and needs on a commodity-by-commodity level be more thoroughly understood, presented, and defended by Canadian representatives at international negotiations (e.g. GATT and UNCTAD). There was some criticism of the widely held assumption that imports *per se* are bad, while exports are good.

Implications for Industry

Discussion of the implications for the industry of current trends in mineral trade kept returning to the topic of research and development. Research in methods of recovery and processing of minerals can contribute to improved productivity and decreases in costs per unit of output. Customer- and problem-oriented research plays an important role in marketing, and requires proximity to the customers. Research inspired by final-use applications can lead to new markets for mineral products, and may help to regain markets lost to substitutes. Sales of technology and technological services, as well as goods, can also result when research and development programs provide industry leadership.

At the same time, some participants stressed that research and development should not be considered a panacea for industry problems. Exploration and development must also be pursued actively to ensure a continuing supply of minerals to meet the demands that are expected to result from research, development, and sales efforts.

SUMMARY

There was a general consensus that Canada is experiencing a relative decline in mineral trade, particularly in terms of Canada's share of world markets.

There was less consensus on the impact of this decline on the balance of payments, or on the potential for reducing the balance of payments deficit through an increase in mineral exports. However it was agreed that a balance of payments should not be considered a policy goal in itself, but rather a constraint on policy.

The implications of the decline in mineral trade for economic development were apparent. Discussion concentrated on policy measures to encourage growth in the mineral industry and in mineral trade. Further processing of minerals should not be pursued *per se*, but opportunities for further processing should be evaluated on an individual basis and encouraged when economically desirable.

Suggestions for the encouragement of the mineral industry included the following:

- taxation levels that permit a reasonable rate of return
- elimination of conflict and uncertainty in federal and provincial regulations
- government support, in the form of loans or equity participation, for mineral development
- government support of mineral development through investment in infrastructure facilities
- encouragement of further processing only when it can be shown to be economically desirable
- government support of applied research and development, and increased research and development efforts by industry
- recognition and protection of Canada's special interests and needs in international trade negotiations.

APPENDIX I

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Mr. A. Clarke,
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Mr. L. deBever,
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Ms. L.M. Wesa,
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Mr. J.V. Wessinger,
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Dr. B.W. Wilkinson,
Department of Economics,
University of Alberta,
Edmonton.

Mrs. M.J. Wojciechowski,
Centre for Resource Studies,
Kingston.

APPENDIX II

PROGRAM OF THE SEMINAR

Wednesday, September 6th

5:30 pm - 7:30 pm	Arrivals, Cocktails, Dinner
7:30 pm - 8:30 pm	*Trends in Canada's Mineral Trade: Implications for an Industrial Strategy* B.W. Wilkinson, Department of Economics, University of Alberta
8:30 pm - 9:30 pm	Questions and Discussion
9:30 pm - Onwards	Individual Study

Thursday, September 7th

8:30 am - 10:00 am	*The Form and Magnitude of Canada's Mineral Trade: Implications for Future Resource Policy* D. McCulla, Mineral Economics Division, Energy, Mines and Resources, Ottawa
10:00 am - 10:15 am	Coffee
10:15 am - 11:45 am	*New Mine Development: The Impact on Canada's Balance of Payments* J. MacKinnon, Department of Economics, Queen's University
11:45 am - 1:00 pm	Lunch
1:00 pm - 3:15 pm	Open Session Discussion
3:15 pm - 3:30 pm	Tea
3:30 pm - 5:00 pm	*Corporate Perspectives on the Further Development of Minerals in Canada* A.G. Balogh, Director of Metallurgical Operations, Noranda Mines Limited
5:00 pm - 7:00 pm	Dinner
7:00 pm - 8:30 pm	*Resource Management Strategies for Penumbra Countries in the North-South Dialogue* W. Chambers and J. Reid, Energy, Mines and Resources
8:30 pm - Onwards	Small Group Discussions

Friday, September 8th

9:00 am - 11:45 am	Open Session Discussion

THE AUTHORS

A.G. Balogh is the Director of Metallurgical Operations with the Noranda Group, and President of Canadian Electrolytic Zinc Limited. After graduating from McGill University with the degree of Bachelor of Engineering in metallurgy, he supervised and managed the operation and expansion of smelting operations at several locations in Quebec. Mr. Balogh is currently involved in feasibility studies concerning a number of proposed smelting projects in Canada, Europe, and Latin America.

Winston G. Chambers is a graduate of Queen's University and the London School of Economics. He worked for various government departments before joining the Mineral Economics Division of the Department of Energy, Mines and Resources.

D.J. McCulla graduated in Economics from Ottawa University, and received his Masters degree from Carleton University. He is presently an economist with the Mineral Policy Sector of the Department of Energy, Mines and Resources with an interest in the relations between the mineral industry and economic development.

James McKinnon is Associate Professor of Economics at Queen's University. He holds a B.A. (Hon.) from York University, and an M.A. and Ph.D. from Princeton University. He has also been employed in the research department of the Bank of Canada.

John S. Reid holds degrees from the University of North Carolina, Université d'Aix-Marseille, and Carleton University. After working for the London brokerage firm of Vickers da Costa, he joined the Mineral Economics Division of the Department of Energy, Mines and Resources.

Bruce W. Wilkinson, a native of Saskatchewan, was born in 1933. After taking the B. Comm. degree at the University of Alberta he worked in the petroleum industry for seven years. Dr. Wilkinson then became interested in economics and received the degrees of M.A. from the University of Alberta and Ph.D. from Massachusetts Institute of Technology in that discipline. Since 1974 he has taught economics, first at the University of Saskatchewan and then at the University of Alberta, where he is a professor and Chairman of the Department of Economics.

THE CENTRE FOR RESOURCE STUDIES

The Centre was established in 1973 through the sponsorship of Queen's University, the federal Department of Energy, Mines and Resources, and The Mining Association of Canada. A multi-disciplinary research organization, it attempts to bring the knowledge, experience, needs, and views of individuals from governments, industry, universities, labour, and other interested groups to bear on important issues underlying mineral resource policy. Mineral resources considered by the Centre include the metallic, industrial and non-metallic, and structural minerals, but exclude petroleum and natural gas.

The prime function of the Centre is to carry out a program of research and publication on mineral policy issues. The program provides research and educational opportunities in resource studies at Canadian universities, and furnishes reliable information to promote a more fruitful exchange between representatives of the various groups concerned with resource policy. Through the continuing support of the sponsors, research by qualified investigators is funded at the Centre, in various departments at Queen's University, and at other Canadian universities. The Centre's publications attempt not only to provide reliable data, but to present research results in a clear and readable form. Reports employ non-technical language, so far as the subject allows, to enhance their value to non-specialists. In this way, the Centre hopes to assist and broaden informed discussion of the issues.

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